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THESIS

IN SEARCH OF COMBAT READINESS
IN THE U.S. MARINE CORPS

by

Paul R. Stahl

December 1985

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In Search of Combat Readiness
in the U.S. Marine Corps

by

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B.A., University of Missouri, Kansas City, 1974

Submitted in partial fulfillment of the
requirements for the degree of

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December 1985

ABSTRACT

This study is an analysis of the factors that make a U.S. Marine Corps unit combat ready. It focuses upon "resource" readiness factors and provides a general systems view of readiness of a MAGTF. It contains the results of a survey, of 46 Marine officers, based upon a readiness model derived from the JCS UNITREP system. The survey data was analyzed using a Bootstrap methodology, whereby quantitative values are derived from qualitative value judgements.

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GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

<u>Term</u>	<u>Abbreviation, Acronym, or Definition</u>
ACE	Air Combat Element
ADCON	Administrative Control
ATF	Amphibious Task Force
CE	Command Element
CINC	Commander-in-Chief (Fleet or Theater)
CINCPAC	Commander-in-Chief, Pacific
CINCLANT	Commander-in-Chief, Atlantic
CINCEUR	Commander-in-Chief, Europe
CSSE	Combat Service Support Element
DOD	Department of Defense
GCE	Ground Combat Element
HQMC	Headquarters, U.S. Marine Corps
JCS	Joint Chiefs of Staff
MAB	Marine Amphibious Brigade
MAGTF	Marine Air-Ground Task Force
MAF	Marine Amphibious Force
MAU	Marine Amphibious Unit
MCCRES	Marine Corps Combat Readiness Evaluation System
MCDEC	Marine Corps Development and Education Center
NPS	Naval Postgraduate School
OPCON	Operational Control

PHIBRON	Amphibious Squadron
SOP	Standard Operating Procedure
UNITREP	Unit Identity and Status Report
YOS	Years of Service

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I. INTRODUCTION

A. AREA OF RESEARCH

Did you ever wonder if you could identify, segregate and assign values of importance to the factors that make a Marine Air-Ground Task Force (MAGTF) combat ready? Have you ever tried to identify what combat readiness factor differences exist between the air, ground and combat service support elements of a MAGTF? Do you feel that the factors of readiness included in the joint service Unit Status and Identity Report (UNITREP) are adequate measures of combat readiness of a MAGTF?

B. BACKGROUND

As a graduate student working on my thesis, I had the opportunity to conduct research on these questions. My interest in this topic began while I was a member of a class titled Manpower Policy Analysis. The course professor was Thomas G. Swenson and he recognized that manpower policy issues of an organization were a function of numerous other policy issues. Accordingly, the course focused on a total systems approach of military organizations. One of the major themes of the course was that of relating "resources to readiness" and the class was exposed to many issues pertaining to UNITREP. (Note: The major factors of

readiness included in UNITREP are personnel, equipment and supplies on hand, equipment condition and training.)

The course required class members to organize into small groups and pick a naval organization to research the factors of readiness thereof. Subject groups were further required to present their research results in a paper reflecting a total systems overview of the organization they studied. I was a member of a group comprised of three naval surface line officers and we selected a naval Amphibious Task Force (ATF) for our analysis.

When my group developed its first ATF readiness model for analysis we inadvertently included all of the factors associated with the four pillars of military capability, i.e., structure, modernization, readiness, and sustainability. When we redeveloped our model we did so with objectives to: 1) focus on factors relating only to "readiness" and 2) include only factors that we could develop recommended measurements for. By default, the major readiness factors we listed in our final model related closely to the readiness factors included in UNITREP. My group's ATF readiness model included personnel, equipment, training and command/control as major factors--differing from UNITREP by command/control (ATF model) and equipment and supplies on hand (UNITREP).

In that a MAGTF is a major element of an ATF, I decided to build upon my group's research of ATF readiness in

general and to devote my thesis research solely to combat readiness of a MAGTF.

My thesis study began by surveying 45 Marine officers at the Naval Postgraduate School (NPS). I wanted their help in evaluating a MAGTF combat readiness model that I intended to use for further analysis. I wanted them to tell me what factors I had listed were considered important in respect to measuring combat readiness of a MAGTF. Additionally, I asked their recommendations for additions, deletions or modifications to the model I proposed. I asked them to consider being assigned to an appropriate billet of a Marine Amphibious Brigade (MAB), that was afloat or an air alert, when the word came down to "land the landing force" or "fly away" and what they would want to see, hear and have available in their unit at that time. Some of the recommendations they gave me were surprising, yet others just confirmed concepts I thought were applicable.

Using the input from my initial NPS survey, I developed an enhanced MAGTF combat readiness model to obtain additional research data from. I did not desire to conduct a mail order survey saga and wanted to have as much personal interaction as possible with my survey participants. Due to the constraints of time and TAD funds, I needed to select a geographic region that would allow me efficient access to officers with air, ground and combat service support

experience. Headquarters, U.S. Marine Corps (HQMC) and the Marine Corps Development and Education Center (MCDEC) allowed me such access. In respect to MCDEC I obtained approval to survey a selected group of officers at the Command and Staff College (C&SC) and the Amphibious Warfare School (AWS).

The results of my study provides the expert value judgements of 46 officers at HQMC, C&SC, and AWS. Some of the individuals I surveyed were the finest from their occupational fields and others (like myself) were representative of average Marine officers. Yet, I am confident that the input they provided is representative of the major cross-sections in our Marine Corps today.

When I started in search of combat readiness in the U.S. Marine Corps, I was not sure of what I would or should find along the way. I was cautioned that many important combat readiness factors were qualitative and could not be measured. This turned out to be true with respect to some factors. Yet, my search was a most interesting and motivating experience. I learned a tremendous amount from the officers I surveyed and hope that other officers in the U.S. Marine Corps can benefit from the data I have compiled.

II. WHAT IS A MAGTF?

A. BASIC ORGANIZATION

Marine forces are task organized into MAGTFs for combat operations. A MAGTF consists of a command element (CE), ground combat element (GCE), an aviation combat element (ACE), and a combat service support element (CSSE), organized as shown in Figure 2.1.

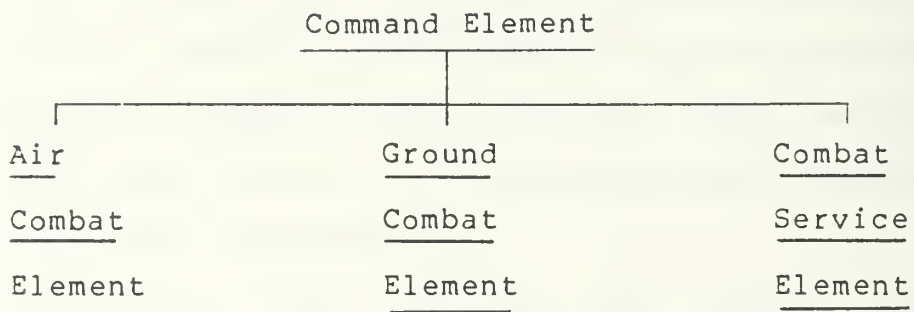


Figure 2.1 Basic Organization of a MAGTF

Three sizes of a MAGTF may be formed: a Marine amphibious force (MAF) formed around a reinforced infantry division, a Marine amphibious brigade (MAB) formed around a regimental landing team, or a Marine amphibious unit (MAU) formed around a battalion landing team.

Similar organizational concepts are embodied in all three MAGTFs. Readiness factors identified for one sized MAGTF should also apply to the other MAGTFs.

B. CURRENT MAGTF HEADQUARTERS

For background purposes, the U.S. Marine Corps has 13 permanently staffed MAGTF Command Elements shown in Figure 2.2. [Ref. 1:p. 5]

<u>West Coast</u>	<u>East Coast</u>	<u>Western Pacific</u>
I MAF	II MAF	III MAF
5th MAB	4th MAB	1st Bde
7th MAB	6th MAB	9th MAB
11th MAU	22nd MAU	
13th MAU	24th MAU	

Figure 2.2 Current U.S. Marine Corps MAGTF Headquarters

III. WHAT IS READINESS IN GENERAL

A. SEGREGATING READINESS FROM THE FOUR PILLARS OF MILITARY CAPABILITY

There are four distinct elements of military capability, that when combined provide the total force capability of the U.S. Armed Forces. These four distinct elements are often referred to as "the four pillars" of military capability within the Department of Defense (DOD). They are defined as follows:

- 1) Force Structure - The numbers and types of organized units, active and reserve, of operating ships (or crafts) and aircraft, and the facilities of the supporting base infrastructure.
- 2) State of Modernization - The level of weapon system technology reflected in the components of the force structure.
- 3) Readiness - The degree to which the operating units in the force structure are capable of performing the tasks for which they were designed and organized.
- 4) Sustainability - The ability of operating forces to conduct . . . operations over extended periods.
[Ref. 2:p. 5]

The focus of this study will be on "readiness" and associated factors as designated by the shaded areas in Figure 3.1.

B. READINESS DEFINED

Numerous definitions of the term readiness exist within and outside of the DOD community. For the purpose of

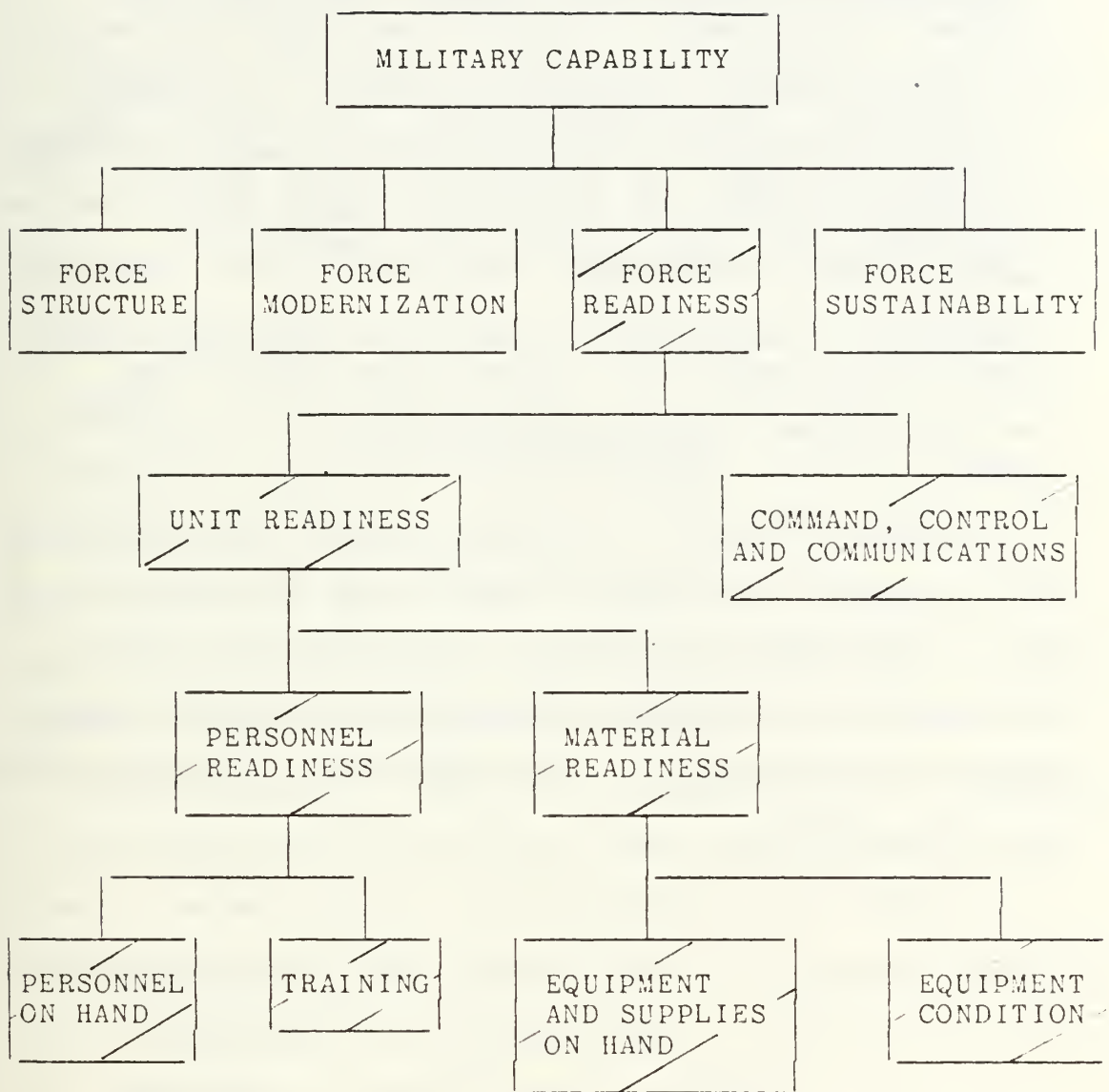


Figure 3 Readiness Factors within the "Four Pillars" of Military Capability

brevity, the following combined statements capture the focus on readiness used throughout this study:

Readiness is the ability of forces, units, weapons systems, or equipment to deliver the outputs for which they were designed (including the ability to deploy and employ without unacceptable delays). It depends on having the required quantities of equipment in the hands of the units on a day-to-day basis and on having the required number of adequately trained people assigned with the necessary mix of grades and experience level and to ensure that people and machines can work together. [Ref. 3:p. 10]

Readiness is essentially a measure of pre-D-Day status (extending at most into initial combat operations) while sustainability is a post-D-Day measure. Hence, we often speak of peace time readiness, but combat sustainability. [Ref. 4:p. 10]

The first definition includes training (individual and unit), material, equipment, logistics and personnel all as part of the readiness concept. The second definition distinguishes between pre- and post-D-Day measures and segregates "readiness" as a peacetime level of preparedness to go into combat.

IV. HOW IS U.S. MARINE CORPS READINESS MEASURED?

The U.S. Marine Corps is frequently referred to as this nation's force in readiness and devotes much attention to assessing unit combat readiness. Two reports whose specific objectives are to report unit readiness are UNITREP and the Marine Corps Combat Readiness Evaluation System (MCCRES).

A. MCCRES

MCCRES is designed to assess unique U.S. Marine Corps air-ground team combat readiness. It was implemented in July 1978 and is used to test Infantry, Fixed Wing, Rotary Wing, Aerial Observation, Combat Support and Combat Service Support units, both regular and reserve.

MCCRES evaluates units in 10 categories and is conducted in accordance with Marine Corps Order 3501.2, Volumes I-X. Separate volumes provide instructions on how a MCCRES is to be conducted for each type of unit. The categories each unit is evaluated in are as follows:

- 1) Reporting to higher level of command.
- 2) Preparing for operations.
- 3) Communicating (including communications SOP).
- 4) Performing as Marines (e.g., discipline, dispersion, camouflage, concealment, using weapons).
- 5) Delivering supporting fire.

- 6) Planning of operations.
- 7) Conforming to doctrine.
- 8) Executing operations.
- 9) Providing combat service support (including medical support).
- 10) Supervising required actions by individual Marines.
[Ref. 5:p. 7]

The quantitative percentile score of a MCCRES test is accumulated from "yes/no/not applicable" evaluations as judged by experienced, expert evaluators. Yet,

Officially, there is no relationship between the numerical score for the Battalion and the Combat Ready/Not Combat Ready rating One battalion with an overall numerical score of 50 could be judged Combat Ready, while another having a numerical score of 75 could be judged Not Combat Ready. [Ref. 6:p. 10]

The prime focus of MCCRES is upon operational combat readiness and the final grade assigned to a unit is either "Combat Ready" or "Not Combat Ready". Yet, whether or not a unit is combat ready can only be determined under actual combat conditions. Therefore,

The Marine Corps must substitute simulated combat for actual combat Thus, for MCCRES, the Marine Corps test adherence to doctrine, under simulated combat conditions as a proxy for the real question.
[Ref. 7:p. 6]

MCCRES was developed due to a need by the Marine Corps for:

. . . an improved readiness evaluation system to, provide a timely and accurate evaluation of readiness of the Fleet Marine Forces, including reserve units, to accomplish assigned missions. [Ref. 8:p. 5]

Unfortunately, due to the constraints of time, conducting single person research and TAD funds I was unable to conduct an indepth study of MCCRES. Yet, based upon discussions with many Marine officers, I perceive that MCCRES was developed partially as a Marine Corps specific improvement to the Joint Chief of Staff (JCS) Force Status (FORSTAT) systems, which later was modified and renamed UNITREP. Whether or not UNITREP is an adequate measure of U.S. Marine Corps combat readiness will be one of the major focuses in the remainder of this study.

B. UNITREP

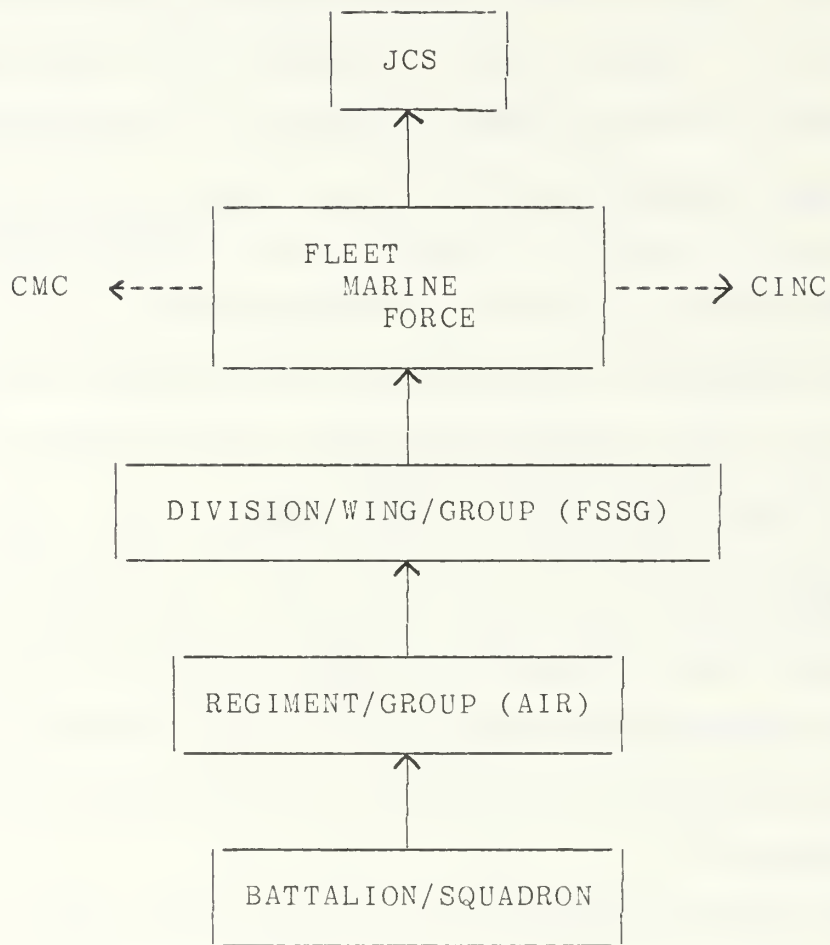
UNITREP was implemented in April 1980. All U.S. military services are required to report required data, via the appropriate chain, to the JCS in accordance with JCS Publication 6.

Like MCCRES, each service is required to report on only combat, combat support, and service selected combat service support units.

UNITREP requires information only on certain selected resources controlled by or organic to the reporting unit.

UNITREP does not attempt to evaluate units in regards to a specific operational plan or mission area.

Within the U.S. Marine Corps, UNITREP reporting originates at the battalion, squadron, or separate deployable



_____ UNITREP OPERATIONAL FLOW
----- UNITREP INFORMATIONAL FLOW

Figure 4.1 U.S.M.C. Flow of UNITREP Reports

unit level and flows to the JCS via the operational chain depicted in Figure 4.1. [Ref. 2:p. 10]

The UNITREP system, applicable to the U.S. Marine Corps, enables units to report readiness of resource areas (personnel, equipment and supplies on hand, equipment condition and training) and of unit "overall" readiness.

UNITREP data is quantified on a nominal scale by means of combat (C) ratings:

C-1 = fully ready

C-2 = substantially ready

C-3 = marginally ready

C-4 = not ready

Even though UNITREP provides a quantified scale for the measurement of each resource area, the unit commander must make a judgemental decision of his unit's "overall" combat rating, i.e., "ready" or "not ready".

Listed below are the major resource areas, their sub-factors and the quantitative rating scale used to determine C-ratings within the U.S. Marine Corps [Ref. 8: pp. A15-A16]

(Note: The percentages in parenthesis refer to air units):

C-RATING DETERMINATION

1) PERSONNEL

<u>CRITERIA</u>	<u>RESOURCE AREA COMBAT RATING</u>			
	<u>C-1</u>	<u>C-2</u>	<u>C-3</u>	<u>C-4</u>
a) Total available strength divided by structured strength.	<u>>90%</u>	<u>>80%</u>	<u>>70%</u>	<u><70%</u>

b) Military service-selected critical MOS qualification of available strength divided by structured strength of critical MOS. >85% >75% >65% <65%

c) Grade fill of military service-selected critical sergeant and above available divided by structured strength of critical sergeants and above (optional by service). >85% >75% >65% <65%

2) EQUIPMENT AND SUPPLIES ON HAND

<u>CRITERIA</u>	<u>RESOURCE AREA COMBAT RATING</u>			
	<u>C-1</u>	<u>C-2</u>	<u>C-3</u>	<u>C-4</u>
a) Total military service-selected combat-essential equipment possessed divided by prescribed wartime requirement. Aircraft percentages in parentheses.	<u>>90%</u> (90%)	<u>>80%</u> (80%)	<u>>65%</u> (60%)	<65% (60%)
b) Total military service-selected end items, support equipment and supplies possessed divided by prescribed wartime requirement.	<u>>90%</u>	<u>>80%</u>	<u>>65%</u>	<65%

3) EQUIPMENT

<u>CRITERIA</u>	<u>RESOURCE AREA COMBAT RATING</u>			
	<u>C-1</u>	<u>C-2</u>	<u>C-3</u>	<u>C-4</u>
a) Total military service-selected combat-essential equipment possessed and combat ready divided by prescribed wartime requirement. Aircraft percentages in parentheses.	<u>>90%</u> (<u>>75%</u>)	<u>>70%</u> (<u>>65%</u>)	<u>>60%</u> (<u>>50%</u>)	<60% (<50%)
b) Major service-selected end items of equipment possessed and combat ready divided by prescribed wartime requirement.	<u>>90%</u>	<u>>70%</u>	<u>>60%</u>	<60%

4) TRAINING

<u>CRITERIA</u>	<u>RESOURCE AREA COMBAT RATING</u>			
	<u>C-1</u>	<u>C-2</u>	<u>C-3</u>	<u>C-4</u>
a) Weeks of training required.	<u><2</u>	<u>>2<4</u>	<u>>4<6</u>	<u>>6</u>
b) Or, percent of combat ready aircrews.	<u>>85%</u>	<u>>70%</u>	<u>>55%</u>	<u><55%</u>
c) Or, percent of unit training completed.	<u>>85%</u>	<u>>70%</u>	<u>>55%</u>	<u><55%</u>

Whereas MCCRES focuses upon unit operational combat readiness, I feel that UNITREP's focus is upon unit resource combat readiness. Thus, for UNITREP, a unit's combat readiness rating is a function of its resource level, that includes training achieved as a resource. A more detailed examination of the value of UNITREP as a measure of U.S. Marine Corps combat readiness will be presented in Chapters VII and VIII. Before that, a general systems view of UNITREP combat readiness of a MAGTF will be provided.

V. A GENERAL SYSTEMS VIEW OF COMBAT READINESS OF A MAGTF

For the concept of combat readiness to have better meaning, a working definition of organizational combat readiness would be helpful. Following is a discussion of a generalized systematic model of MAGTF combat readiness that addresses MAGTF elements and attributes in respect to the overall MAGTF (system). [Ref. 10:pp. 12-15]

Definition: As depicted in Figure 2.1 a MAGTF fits well into a standard characterization of system, i.e., "it is an assembly of parts or components connected together in an organized way The parts are affected by being in the system and are changed if they leave it"

Elements: "Elements are the components of each system. System elements can in turn be systems in their own right" Coincidentally, the subsystems of a MAGTF are called "elements", i.e., command, air, ground and service support.

Inputs and Resources: Each element of a MAGTF is an "input" to the overall system. Prior to going under the operational control of a designated MAGTF, each combat element is required to complete a specified training plan and be operationally certified in 10 specific categories via

MCCRES. The "resources" applied to the MAGTF elements directly relate to their readiness status.

Conversion Process: The major processes by which MAGTF elements are converted into an air-ground task force are:

- The actual change in operational and administrative control (OPCON and ADCON) from parent units to designated MAGTFs.
- The OPCON and ADCON assignments of the MAGTF to Navy amphibious task forces or other unified command structures.
- Joint training of MAGTF elements internally and externally with other services/allied forces.
- Operational exercises of the MAGTF with other services/allied forces.

Outputs: The desired outputs of a MAGTF is to obtain a unit which can shoot, move and communicate independently or in a joint task force environment, if necessary.

Attributes: The attributes that follow will give initial emphasis only to the following "quantity-like" UNITREP measures:

- Personnel: % fill of total manning level, % fill of critical MOS and % fill of critical E-5 and above billets.
- Equipment and Supplies (Quantity): % fill of required equipment and % fill of total required end items, support equipment and supplies.
- Equipment (Condition): % fill of required combat-essential equipment possessed and "combat ready" and % fill of major end items possessed and "combat ready".
- Training: Weeks of training required or % of combat ready air crews or % of unit training completed.

Note: UNITREP allows unit commanders a great deal of discretion in regards to assigning their "overall" readiness status due to the existence of many qualitative factors.

The Environment: As mentioned above MAGTFs are designed to be part of larger joint service task forces. MAGTFs are dependent upon the Navy for amphibious lift and a variety of service/support functions. If designated as part of a RDJTF, air lift support from the Air Force becomes necessary.

As a point of interest, MAGTFs are routinely under the OPCON of a Navy amphibious task force, which via a fleet command is under the OPCON of a geographic unified command, i.e., CINCPAC, CINCATL, CINCEUR, etc. However, if not deployed, ADCON is usually retained by the Marine Corps. The ADCON chain of command is primarily responsible for the allocation of combat readiness resources (personnel, equipment/supplies, equipment maintenance, and training). Thus, an operational MAGTF has to interact with two primary environmental hierarchical systems. Figures 5.1 and 5.2 are basic examples of such systems.

Goals, Objectives, Purpose and Function: MAGTFs are one among many options our national leaders have available to pursue national security and foreign policy objectives. MAGTFs, as part of NAVAL amphibious task forces, are one of the vehicles frequently used to display one of our national

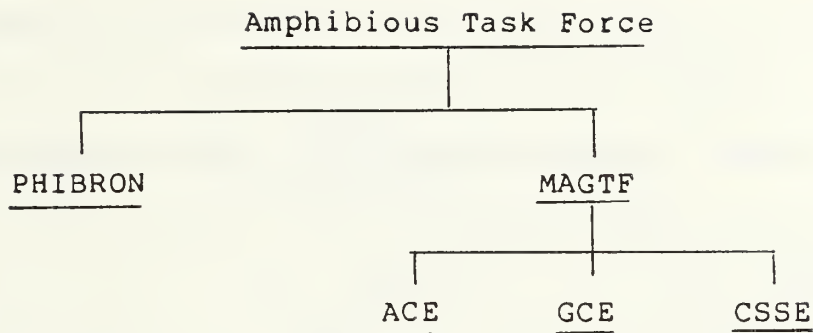
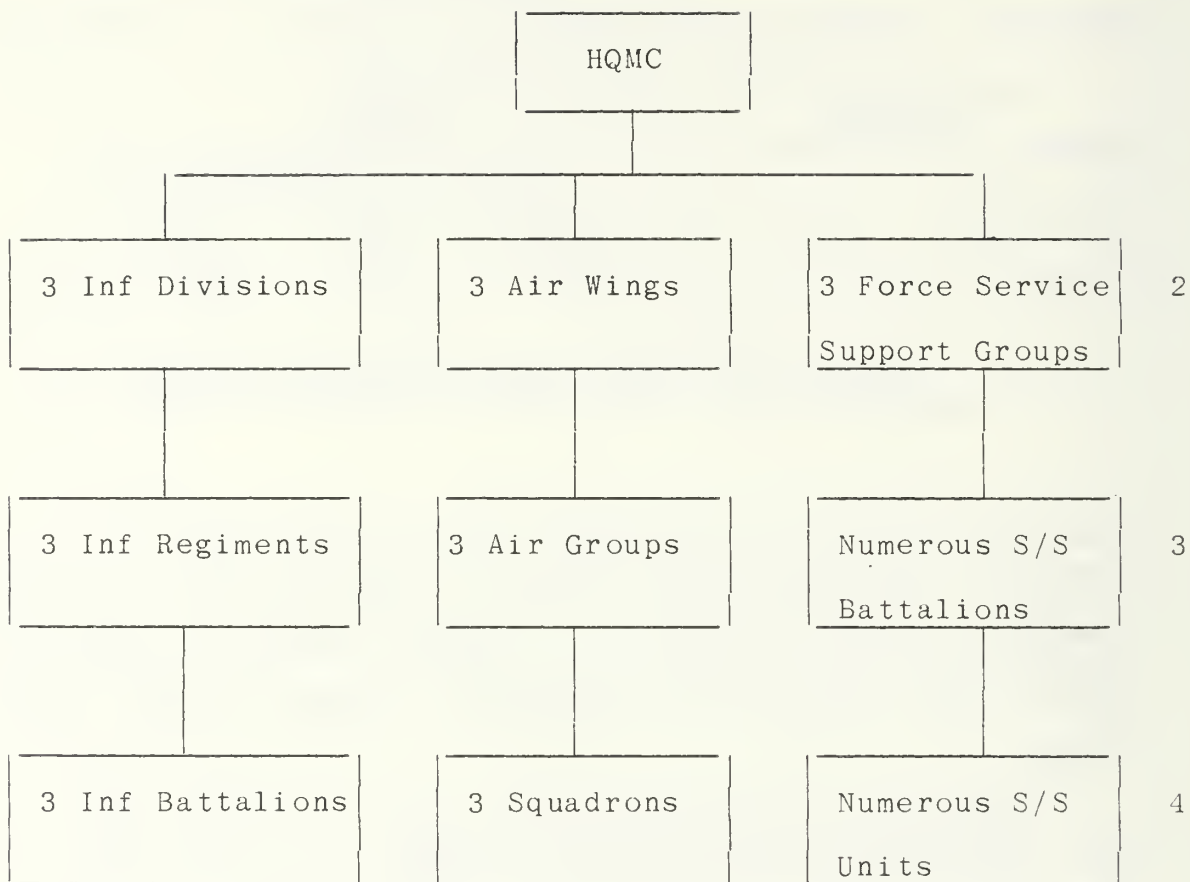


Figure 5.1 Basic MAGTF OPCON Environment

goals of "peace through strength". MAGTFs give our national leaders the availability of a combat ready force that can meet a wide range of contingencies, on short notice, world wide.

Components, Programs and Missions: As mentioned earlier, a MAGTF must be able to coordinate/operate with many components outside of its boundaries. MAGTFs can be organized to perform a variety of programs and missions.

The nature of the mission is a key factor this dictates the units assigned to and the size of a MAGTF. During World War II, MAF sized forces were primarily used in the Pacific. In Korea, a MAB was formed to rescue Army forces trapped in the Pusan perimeter and later was expanded to a MAF for the Inchon landing. In Vietnam OPCON of Marine forces rested with III MAF and standby MAUs were frequently off shore at "Yanky Station". In recent times MAUs have been used to



- NOTE: 1. Prior to going OPCON to a MAGTF the SOP is that subject units will have required personnel, equipment and unit specific training.
2. Elements of a MAF.
3. Elements of a MAB.
4. Elements of a MAU.

Figure 5.2 Basic ADCON MAGTF Element Enviroment

fight numerous brush fires around the world, i.e., MAU sized Marine units participated in Grenada and Lebanon.

Management, Agents and Decision Makers: Within a MAGTF, the personnel filling the traditional chain of command billets will be the "key players", i.e., the element commanders and their staffs. In regards to this thesis, a prime focus will be upon commanding officers. However, specific agencies will need to be recognized due to their cognizance over the readiness factors of interest, i.e., the G-1 (personnel), G-3 (operations and training) and G-4 (supply and logistics).

Structure: Formal structures as depicted above are engrained in doctrine.

States and Flows: The Marine Corps 13 MAGTF command elements have two primary states they can be in at a point in time. They are either deployed under the OPCON of a Naval Amphibious task force or they are preparing for deployment.

MAGTF command elements are permanently staffed. The normal CONUS tour with a MAGTF staff is two years in which one would make two six months deployments. The normal overseas tour with a MAGTF staff (III MAF or 9th MAB) is 12 months.

However, MAGTF air, ground and service support elements have three primary states. They can be preparing for

deployment, be deployed or be recovering from deployment. The air, ground and service support elements are usually rotated under the OPCON of a MAGTF for only six months at a time.

Within the FMF, resources flow to and from units based upon their deployment status. Units entering a deployment cycle are routinely given priority in regards to personnel, equipment and training resources. The goal is for a unit to peak as it embarks for a deployment with a MAGTF.

Figure 5.3 is provided to summarize the author's general systems model view of combat readiness of a MAGTF.

STRUCTURE

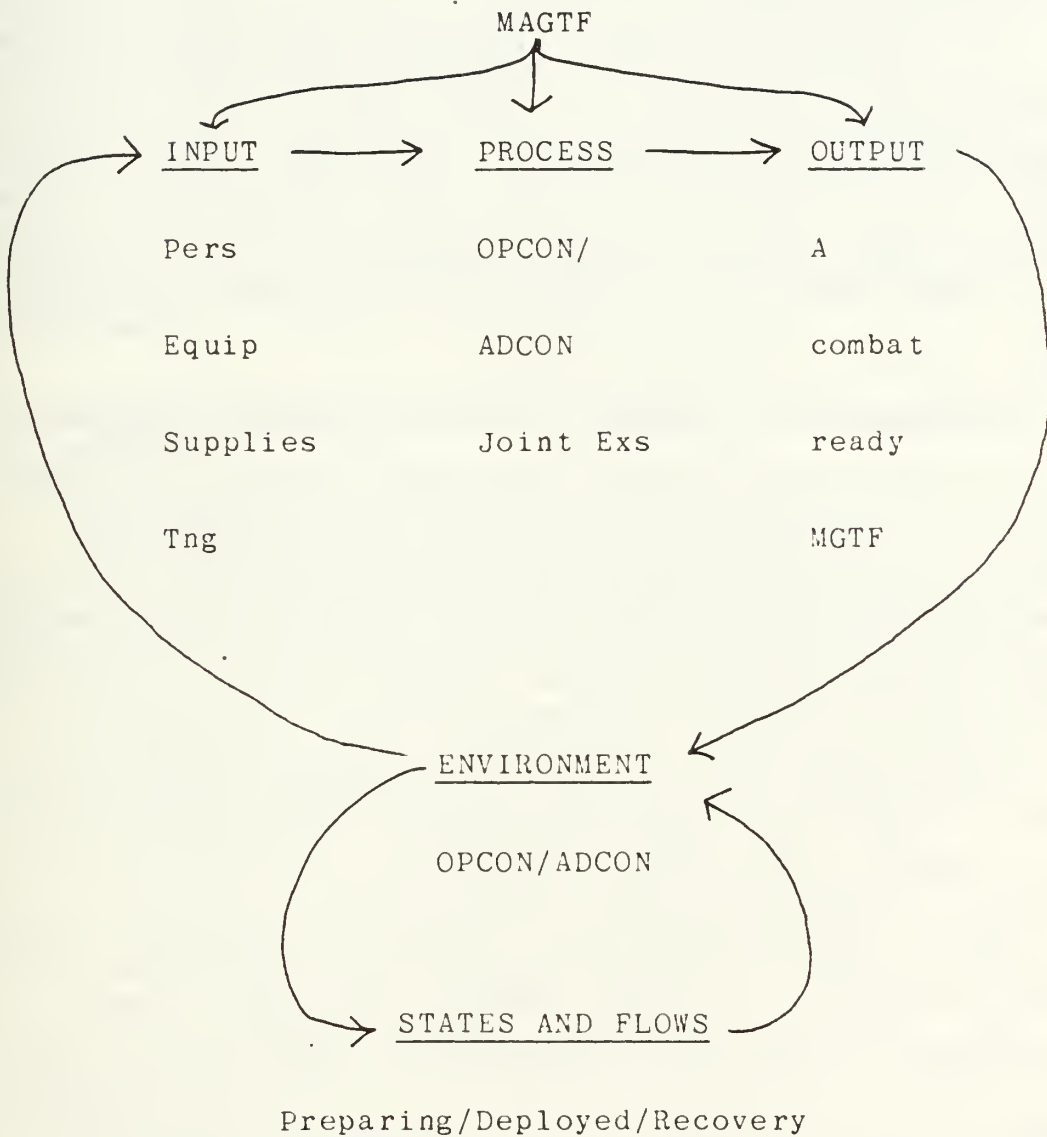


Figure 5.3 General Systems View of MAGTF Combat Readiness

VI. MAGTF COMBAT READINESS SURVEY METHODOLOGY AND MODEL

A. GENERAL CONCEPTUAL OVERVIEW

Even though formalized combat readiness definitions and measures exist (JCS Pub. 6, UNITREP, MCCRES, etc.), unit combat readiness still remains a very abstract and relative term to many in the U.S. Marine Corps. Every unit has its own unique idea of what constitutes its combat readiness and these ideas no doubt vary widely.

In respect to UNITREP's focus on resource readiness, a working definition of what unit combat readiness is must be of practical significance to MAGTF command and combat element commanders. This is due to the fact that resource dollars and assets are scarce. Thus, in order to lobby for or allocate resources efficiently in the attainment of combat readiness, to know the relationship between resources and readiness would be most helpful.

So, if understanding the resource to readiness relationship is important to MAGTF command and combat element commanders, it additionally should be understood at all levels within the MAGTF's OPCON and ADCON organizations. That is, combat readiness as an objective should be clearly understood at all levels (vertical and horizontal) if you want to manage it effectively.

If the resource to combat readiness relationship and objective is not interpreted the same at each level within the MAGTF, then the information exchange process could be potentially distorted. Also, the relationship between resources and readiness could not be shared and continuity of effort could be hampered.

Based upon the above concepts, this study utilized a survey methodology based upon a systemic view and a model-oriented (linear regression) perspective of MAGTF combat readiness.

B. BOOTSTRAPPING--A SYSTEMIC VIEW OF AN ORGANIZATIONAL PRODUCT

Bootstrapping is a phrase somehow coined from a concept known as "paramorphic representation of clinical judgement." Bootstrapping methodology utilizes mathematical models to "provide a way of describing mental processes which would otherwise be accessible only through introspection or electrophysiological techniques" [Ref. 11:p. 130].

Bootstrapping has evolved into a computerized hierarchical modelling approach and was developed by Professor Paul J. Hoffman and COGITAN. Bootstrapping was developed and implemented as:

A methodology for capturing the intuitions of experts by computer, expressing them in rather simple algebraic form and assessing their reliability. Once defined this way, the derived functions can substitute for the more subjective and time consuming evaluations of experts, and can provide a clear and objective

representation of the value of each facet of a product, regardless of the level of specificity or generalization of the facet. [Ref. 12:p. 6]

The general framework of the Bootstrapping hierarchical model approach is based upon:

A class of judgement models which we at COGITAN refer to as hierarchical scoring models. These models embrace the following features:

- 1) The partitioning of the attributes of systems into logical distinct and meaningful concepts.
- 2) The organization of the concepts into a hierarchical system, in which the elements of a grouping at any given level constitute a list of attributes which define a concept at the next higher level.
- 3) The quantification of human judgement through modelling procedures akin to expert systems in AI. Our utilization of expertise requires individuals familiar with the products, with their features, or with some partitioned subset of features. The resulting models define each concept at each given level of the hierarchy as a function of the values of those elements which comprise the lower-order subset of information to which the node is linked.
- 4) Utilization of the complete hierarchical model to aggregate observable and measurable attributes . . . and to generate product evaluation scores at each conceptual level and node of the hierarchy.

In this way, the evaluation model maps specific features into more meaningful and more generally useful concepts [Ref. 12:pp. 7-8]

The Bootstrap method has two phases: X-Bootstrap which involves identification of expert decision makers and the models they use, and V-Bootstrap which involves the validation of the models by consensus (internal validation) and/or by traditional empirical means. This study will only use the X-Bootstrap phase.

C. X-BOOTSTRAPPING--DEFINED AND APPLIED TO MAGTF COMBAT READINESS

X-Bootstrapping can be defined as "a method for explicating a hierarchical model of organizational (system) effectiveness from organizational experts" [Ref. 13]. The focus of this study in regards to organizational effectiveness is that of combat readiness of a MAGTF. This focus is based upon the following view of MAGTF hierarchical relationships:

- 1) MAGTF combat readiness is a function of subsystem (element) combat readiness;
- 2) Subsystem (element) effectiveness is a function of subsystem (element) outcomes;
- 3) Subsystem (element) outcomes are a function of composite decision maker (DM) performance;
- 4) DM performance is a function of DM behaviors;
- 5) DM behavior is a function of available resources.
[Ref. 14:p. 4]

D. HQMC AND MCCDEC MAGTF COMBAT READINESS SURVEY VIA BOOTSTRAPPING

1. Background on Survey Model Development

As mentioned in the introductory comments, I was a member of an NPS group project that conducted research on the readiness of a Naval Amphibious Task Force. Using UNITREP factors as a foundation, the readiness model described in Appendix A was developed.

At the conclusion of the group project discussed in Appendix A, I decided to devote my thesis research solely to combat readiness of a MAGTF. To obtain help in developing a MAGTF combat readiness model that contained only significant factors for USMC consideration, a survey of NPS Marine officers was conducted. Appendices B and C discuss the development and results of the NPS Marine officer MAGTF combat readiness survey.

2. Overview of Final Survey Approach and Model

HQMC and MCDEC were selected as final survey sites for this study because they allowed efficient access to officers with air, ground and combat service support experience. In respect to MCDEC, approval was obtained to survey officers at the U.S. Marine Corps Command and Staff College (C&SC) and Amphibious Warfare School (AWS).

This is brought up again, because in addition to analyzing horizontal differences between the air, ground and combat service support communities, an additional effort will be made to analyze vertical differences between levels of command. That is, the group of senior colonels (seven surveyed) from HQMC will be used as a proxy for MAGTF commanders. (Note: An unsuccessful attempt was made to obtain flag officer survey input.) The group of Lieutenant Colonels and Majors from C&SC (19 surveyed) will be used as a proxy for MAGTF combat element commanders. Finally, the

group of Captains from AWS (20 surveyed) will be used as a proxy for unit commanders within the MAGTF combat elements. A total of 46 Marine officers were surveyed.

Information obtained from the model development processes discussed in Appendices A, B and C was used to develop a final model to gather data for analysis via Bootstrap methodology. Appendix D contains the final survey package used in this study. Page 82 of this survey package provides general background information for the survey participants. Pages 83 and 84 provides a basic description of the combat readiness factors contained in the survey package. The remaining pages contain combat readiness profiles for assessment.

The final combat readiness model used for analysis is depicted as follows:

- MAGTF Combat Readiness is a function of personnel readiness + equipment and supplies (quantity) readiness + equipment condition readiness + training readiness + command, control, communications (C3) and unit climate readiness;
- Personnel Readiness is a function of percent fill of manning level + percent fill of critical MOS billets + percent fill of E-5 and above billets + service experience of key billet holders;
- Equipment and Supplies (Quantity) Readiness is a function of percent fill of equipment wartime requirements + percent fill of end item, support equipment and supplies wartime requirements;
- Equipment Condition Readiness is a function of percent of required equipment possessed and "combat ready" + percent of required end items possessed and combat ready + modernization of equipment on hand;

- Training Readiness is a function of individual skills training + percent of unit training completed + joining MAGTF element training + MAGTF and Navy training;
- Command, Control, Communications (C3) and Unit Climate Readiness is a function of unit morale + unit leadership + C³ + intelligence capabilities + commanding officers judgement.

3. Combat Readiness Survey Profiles Explained

As discussed above, the MAGTF combat readiness survey model developed consists of five major dimensions, i.e., personnel, equipment and supplies, equipment condition, training and C³ plus unit climate. Accordingly, to obtain statistical significance from the methodology used, assessments of 21 profiles of each major dimension and the overall model was obtained. Thus, each survey participant assessed a total of 126 profiles. (See pages 85 to 131 of Appendix D.)

The numbering scheme of each profile was obtained from a data set of random numbers generated by a SAS [Ref. 15] program written by Professor Paul Hoffman. Appendix E contains the random number data set used to develop each profile and the SAS program that produced it.

For each major combat readiness dimension, the survey participant was given the following instructions:

- Each profile you see portrays an alternative in terms of the dimensions or attributes or MAGTF combat readiness earlier defined.
- Considering just the information you will be shown, what is your assessment of _____ overall?

- Rely upon your knowledge and intuition to rate overall . Use the rating scale that will appear at the bottom of each profile. Note the descriptions given as reference for this scale.

The profile format, scale, numbering scheme and instructions list were derived from a personal computer Bootstrap package, developed by Professor Paul Hoffman and COGITON, called EXPERT77. EXPERT77 is marketed by Magic 7 Software. (See Appendix G for additional details.)

At the time this survey was conducted, the EXPERT77 software package was under development and not available for use. Yet, each individual survey profile developed for analysis is a close replica of the individual screens displayed by EXPERT77. The beauty of EXPERT77 is that it performs the statistical analysis of each dimension's assessment as you go. Yet, due to EXPERT77's unavailability at the time of this survey, the statistical analysis of each dimension was performed by manually inputting each data set into a SAS program. Again, the SAS program used for data analysis was written by Professor Paul Hoffman.

Figure 6.1 is provided in an attempt to graphically display the concepts presented in this chapter. [Ref. 14: p. 8]

Enough on survey methodology. Let's turn to the results.

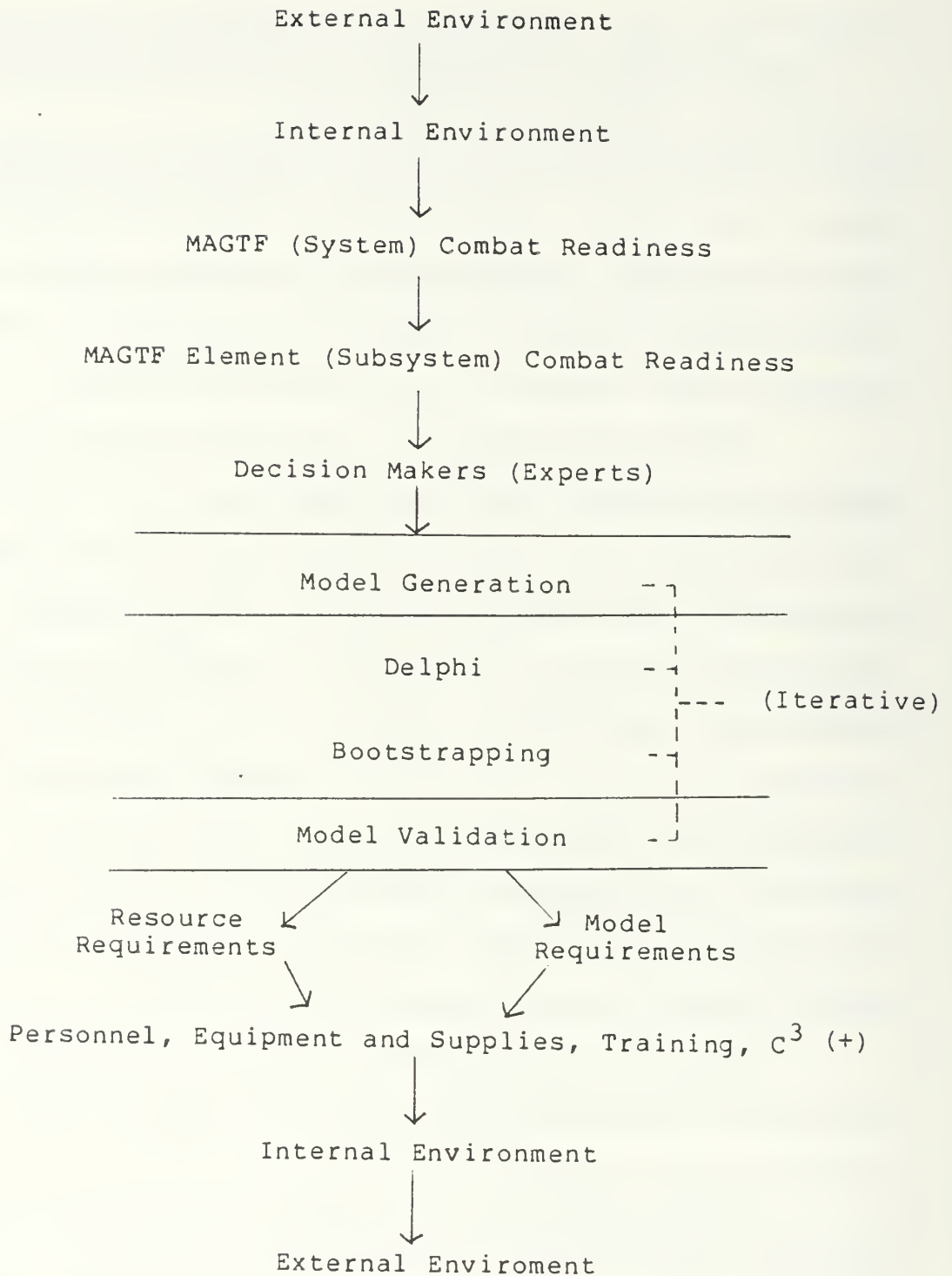


Figure 6.1 MAGTF Systemic View Combined with Model/Methodology Development

VII. HQMC AND MCDEC MAGTF COMBAT READINESS SURVEY RESULTS

Appendix F contains an overview of the statistical terms, formulas, SAS programs and aggregate group data sets used to derive the results in Tables 7.2 to 7.7.

I, in concurrence with my thesis advisors, have decided not to give any personal speculations in regards to the wide spectrum of interpretations that could be drawn from the data provided. Each reader will be left to form his or her own interpretation. The chapter following this will only list factual or statistical conclusions.

To prevent the reader from becoming lost in a maze of numbers, data on individual survey participants is omitted. What is provided, is aggregate group statistics from the following aggregate groups (see Table 7.1):

- Ground Colonels (GNDCOL), four surveyed.
- Air Colonels (AIRCOL), two surveyed.
- Combat Service Support Colonel (CSSCOL), one surveyed.
- Ground Field Grade (GNDFG), ten surveyed.
- Air Field Grade (AIRFG), five surveyed.
- Combat Service Support Field Grade (CSSFG), four surveyed.
- Ground Company Grade (GNDCG), ten surveyed.
- Air Company Grade (AIRCG), five surveyed.

TABLE 7.1
GENERAL INFORMATION ON THE GROUPS SURVEYED

<u>GROUP</u>	<u>NUMBER SURVEYED</u>	<u>AVG RANK</u>	<u>AVG YOS</u>	<u># PRIOR ENLISTED</u>	<u># WITH CBT EXP</u>
GNDCOL	4	06	25	1	4
AIRCOL	2	06	24.5	2	2
CSSCOL	1	06	27	0	1
GNDFG	10	04.6	16.8	1	7
AIRFG	5	04.6	16.4	0	5
CSSFG	4	04	11.75	0	0
GNDCG	10	03	7.3	0	0
AIRCG	5	03	7.6	0	0
CSSCG	5	03	10	0	0
TOTAL	46	04.07	16.26	4	19

- Combat Service Support Company Grade (CSSCG), five surveyed.
- NOTE: Total surveyed equals 46.

In the tables that follow the combat readiness factors are listed vertically, by degree of importance, within each group referred to above. The number below each factor is the normalized weight value (see Appendix F) that was derived by the group. The normalized weight values were rounded to two digits. The total of each group's normalized weight values should equal one. Yet, due to rounding to two digits, some totals will vary slightly.

The factors assessed were abbreviated as follows:

Overall Factors (Table 7.2):

- Personnel = PERS
- Equipment and Supplies = E+S
- Equipment Condition = EC
- Training = TNG
- Command, Control, Communications (C3) and Climate = C4

Personnel Factors (Table 7.3):

- % Manning Level = ML
- % Critical MOS = CMOS
- % E-5's and Above = > E-5
- Service and Experience = SEXP

Equipment and Supplies Factors (Table 7.4):

- % Equipment = EQUIP
- % Supplies = SUP

Equipment Condition Factors (Table 7.5):

- % Equipment Combat Ready = EQUIP
- % End Items Combat Ready = EI

Training Factors (Table 7.6):

- Individual Skills Training = INDIV
- % Unit Training Completed = UNIT
- Joint MAGTF Element Training = MAGTF
- Joint MAGTF/Navy Training = NAVY

C4 Factors (Table 7.7):

- Unit Morale = MORALE
- Unit Leadership = LDRSHP
- Command, Control and Communications = C3
- Intelligence Capabilities = INTEL
- Commanding Officer's Judgement = CO's J

TABLE 7.2

OVERALL MAGTF COMBAT READINESS MODEL VALUES

R2 > RANK	COLONELS				FIELD GRADE				COMPANY GRADE			
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>	
	.75	.94	.75	.90	.89	.70	.96	.81	.81			
1	PERS .45	PERS .29	PERS .44	C4 .27	TNG .27	PERS .25	TNG .30	TNG .32	PERS .31			
2	E&S .19	C4 .25	E&S .19	PERS .22	C4 .24	C4 .21	C4 .22	PERS .22	E&S .21			
3	C4 .14	TNG .16	C4 .14	TNG .20	PERS .22	TNG .19	PERS .17	EC .19	EC .20			
4	EC .13	E&S .16	FC .13	F&S .16	EC .14	EC .18	EC .16	E&S .16	TNG .15			
5	TNG .10	EC .15	TNC .10	EC .16	E&S .12	F&S .17	E&S .15	C4 .11	C4 .13			

TABLE 7.3
PERSONNEL MODEL VALUES

RANK	COLONELS			FIELD GRADE			COMPANY GRADE		
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>
R ² >	.92	.94	.66	.92	.94	.92	.92	.95	.90
1	ML .46	ML .48	CMOS .46	ML .44	ML .33	ML .44	ML .31	ML .35	ML .43
2	SEXP .27	CMOS .23	ML .26	SEXP .20	>E-5 .30	CMOS .26	SEXP .26	CMOS .28	CMOS .22
3	CMOS .16	>E-5 .17	>E-5 .16	CMOS .18	SEXP .23	E-5 .16	>E-5 .26	SEXP .23	>E-5 .21
4	>E-5 .11	SEXP .12	SEXP .12	>E-5 .18	CMOS .15	SEXP .15	CMOS .18	>E-5 .14	SEXP .14

TABLE 7.4
EQUIPMENT AND SUPPLIES MODEL VALUES

	COLONELS			FIELD GRADE			COMPANY GRADE		
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>
R ² >	.84	.84	.69	.89	.86	.91	.92	.89	.87
RANK									
1	EQUIP .60	EQUIP .53	EQUIP .70	EQUIP .60	EQUIP .63	EQUIP .63	EQUIP .56	EQUIP .56	EQUIP .62
2	SUP .40	SUP .47	SUP .30	SUP .40	SUP .37	SUP .37	SUP .44	SUP .44	SUP .38

TABLE 7.5
EQUIPMENT CONDITION MODEL VALUES

	COLONELS				FIELD GRADE				COMPANY GRADE		
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>		
R2 >	.85	.93	.81	.90	.92	.90	.94	.83	.86		
RANK											
1	EQUIP .60	EQUIP .58	EQUIP .77	EQUIP .55	EQUIP .52	EQUIP .54	EQUIP .49	EQUIP .43	EQUIP .51		
2	EI .34	EI .37	EI .14	EI .40	EI .33	EI .37	EI .33	EI .42	EI .37		
3	MOD .06	MOD .05	MOD -.08	MOD .05	MOD .15	MOD .09	MOD .18	MOD .15	MOD .12		

TABLE 7.6

TRAINING MODFL VALUES

	COLONELS				FIELD GRADE				COMPANY GRADE		
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>
R ² >	.89	.94	.71	.95	.94	.86	.96	.88	.96		
RANK											
1	INDIV .44	INDIV .37	INDIV .54	INDIV .48	INDIV .40	INDIV .43	INDIV .44	INDIV .41	INDIV .58		
2	UNIT .35	UNIT .28	UNIT .25	UNIT .34	UNIT .31	UNIT .34	UNIT .25	UNIT .36	UNIT .35		
3	NAVY .11	MAGTF .21	NAVY -.05	MAGTF .11	MAGTF .18	MAGTF .14	MAGTF .17	MAGTF .13	MAGTF .13		
4	MAGTF .09	NAVY .14	MAGTF -.16	NAVY .07	NAVY .09	NAVY .09	NAVY .14	NAVY .11	NAVY .14		

TABLE 7.7

COMMAND, CONTROL, COMMUNICATIONS (C3) AND CLIMATE

RANK	COLONFLS			FIELD GRADE			COMPANY GRADE		
	<u>GND(4)</u>	<u>AIR(2)</u>	<u>CSS(1)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(4)</u>	<u>GND(10)</u>	<u>AIR(5)</u>	<u>CSS(5)</u>
R ² >	.90	.81	.91	.93	.93	.83	.96	.89	.97
1	MORALE .34	C3 .36	MORALE .30	COSJ .35	COSJ .35	COSJ .34	LDRSHP .33	INTEL .28	LDRSHP .27
2	C3 .22	LDRSHP .23	C3 .22	MORALE .21	MORALE .25	MORALE .24	COSJ .26	MORALE .27	COSJ .22
3	COSJ .17	COSJ .20	COSJ .19	LDRSHP .20	LDRSHP .17	LDRSHP .19	MORALE .22	LDRSHP .16	MORALE .19
4	LDRSHP .16	MORALE .15	LDRSHP .17	C3 .14	INTEL .14	C3 .19	C3 .14	COSJ .15	C3 .18
5	INTEL .11	INTEL .06	INTEL .11	INTEL .11	C3 .09	INTEL .03	INTEL .05	C3 .14	INTEL .14

VIII. MAGTF COMBAT READINESS SURVEY CONCLUSIONS AND SELECTED COMMENTS

A. REVIEW OF INITIAL RESEARCH QUESTIONS

First, let's recall what the initial research questions of this study were:

1. Question One

Can the factors that make a MAGTF combat ready be identified, segregated and assigned values of importance?

2. Question Two

What combat readiness factor differences exist between the air, ground and combat service support elements of a MAGTF?

3. Question Three

Are the factors of readiness included in UNITREP adequate measures of combat readiness of a MAGTF?

B. COMMENTS IN REGARDS TO THE INITIAL RESEARCH QUESTIONS

1. Question One

- (a) By using a combination of brainstorming, delphi, survey and bootstrapping techniques (Appendices A to C) with expert judges; MAGTF combat readiness factors can be identified as indicated in Appendix D.
- (b) By using Bootstrap survey methodology, MAGTF combat readiness factors can be segregated and assigned values of importance as indicated in Tables 7.2 to 7.7.
- (c) A better segregation and statistical assessment of the factors in Tables 7.2 to 7.7 could have been

accomplished if larger samples of each group could have been obtained. Yet, to personally administer a survey the size of Appendix D to larger groups and to manually extract the data for analysis thereof:

- (1) would require more time than allowed for this thesis, or
 - (2) would require the efforts of more than one person who was familiar with the techniques used.
- (d) The use of a EXPERT77 personal computer software package could facilitate:
- (1) a savings in time, both in data collection and analysis, for any research team conducting a similar research project.
 - (2) an immediate feedback to survey respondents regarding their assessment of similar models.
- (e) Bootstrap methodology can be used to obtain quantitative values, of qualitative value judgements, for a variety of other topics, i.e., performance evaluation factors, MIS decision support systems factors, etc.

2. Question Two

In regards to the value judgements of those surveyed:

- (a) More similarities, versus differences, existed with respect to the combat readiness factors provided for assessment.
- (b) With respect to the overall model factors (Table 7.2):
 - (1) Personnel was the dominant factor, that is, seven out of nine groups ranked personnel either as first or second in importance.
 - (2) C4 was the second most dominant factor, that is, five out of nine groups ranked C4 either as first or second in importance.
 - (3) No other overall factor was ranked as either first or second by more than five groups.
 - (4) Equipment condition was the least important factor, that is, all groups ranked equipment condition as either last or next to last.

(c) With respect to personnel model factors (Table 7.3):

- (1) Percent manning level was the dominant factor, that is, all groups ranked percent manning level as either first or second in importance.
- (2) Percent E-5's and above was the least important factor, that is, all groups ranked this factor either as last or next to last.
- (3) The assessments of service experience and percent critical MOS factors received mixed results.

(d) With respect to equipment and supplies factors (Table 7.4):

- (1) All groups ranked percent equipment greater than percent supplies by an approximate ratio of 6 to 4.

(e) With respect to equipment condition factors (Table 7.5):

- (1) All groups ranked percent equipment combat ready first, percent end items combat ready second and modernization third.
- (2) Even though modernization was ranked last by all groups, the company grade officer groups assigned it a higher value than the other two groups.

(f) With respect to training factors (Table 7.6):

- (1) All groups ranked individual skills training first and percent unit training completed second. Seven out of nine groups ranked joint MAGTF element training third and Navy/MAGTF training fourth.

(g) With respect to C4 factors (Table 7.7):

- (1) Mixed results occurred between the three rank groups. Yet, due to their different billet perspectives, this should not be surprising.
- (2) Five out of seven colonels ranked morale first. Yet, the two air colonels ranked C3 first and the other five ranked C3 second. So, morale and C3 appear to be the dominant factors among the colonels surveyed.

- (3) All colonels assessed commanding officer's judgement as third.
- (4) Unit leadership was ranked fourth by the ground and combat service support colonels, yet second by the air colonels.
- (5) All colonels ranked intelligence capabilities as least important.
- (6) All field grade officers ranked commanding officer's judgement as first, morale as second and leadership as third.
- (7) Ground and combat service support field grade officers ranked C3 third and intelligence capabilities last. Just the opposite for the air field grade officers.
- (8) Ground and combat service support company grade officers all ranked unit leadership first, commanding officer's judgement second, morale third, C3 fourth and intelligence, again, last.
- (9) The air company grade officers ranking of intelligence as first is an interesting ranking, in lieu that all other groups ranked intelligence last.
- (h) The models provided for assessment in Tables 7.4 to 7.6 were not very good in regards to providing significant factor differences to choose from. Yet, these models highlight how Bootstrapping can segregate and assign values of importance.
- (i) The model in Table 7.7 is an indication of how Bootstrapping can highlight different value judgements possessed by decision makers at different levels within a hierarchical organization.

3. Question Three

I feel that the factors of readiness in UNITREP are adequate measures of "resource" combat readiness of MAGTF units. This belief is contingent upon a unit reporting UNITREP data in a timely and accurate manner. (Note: the

issue of UNITREP data manipulation by unit personnel and higher echelons is beyond the scope of this study.)

Yet, a unit could have a high "resource" readiness rating and still need to be "operationally" certified. This is where MCCRES comes into play.

For example, a unit with a high "resource" readiness rating (UNITREP) could be found not "operationally" combat ready via MCCRES, and visa versus.

Thus, the "overall" combat readiness rating of a MAGTF unit is contingent upon a combination of UNITREP, MCCRES, and other informational data determined necessary at the MAGTF or higher headquarters level.

To conclude my thoughts on UNITREP data, it can facilitate MAGTF "resource" combat readiness as:

- a media for "resource" readiness briefings,
- a source of information on unit resource status before a peacetime MAGTF deployment, and
- an indicator of the potential need to reallocate resources among MAGTF units. [Ref. 2:p. 9]
- There are many ways in which the data in Tables 7.2 to 7.7 could be manipulated for further analysis. One of these ways can be found in Appendix H.

C. SELECTED COMMENTS OF SURVEY PARTICIPANTS

I would like to share with you some selected comments of the officers surveyed. I've included both positive and negative comments. The comments will be listed under the appropriate model category, i.e., overall, personnel,

training, etc. Minor editing of subject comments was made for clarity and to ensure confidentiality of the officer concerned. Comments are included from HQMC, MCDEC and NPS officers surveyed.

1. Overall

- UNITREP does not, in any manner, measure combat readiness in a MAGTF. Readiness should be measured in terms of capabilities vis-a-vis requirements (Colonel, 9906).
- Interesting idea, but it took me a long time to maintain the survey factor definitions in my head. I had to review the definitions provided several times (Lieutenant Colonel, 0302).
- This model was too complicated, administratively busy and difficult to focus on. I don't know what it is, yet there has got to be a better way (Major, 0302). (Note: I agree. EXPERT77 may be the answer.)
- I disagree with the validity of this survey. I do not feel that the categories of this survey appropriately judge combat readiness (Major, 0302).
- Good model. Please send me a copy of the results (Captain, 0302).
- From my limited knowledge of UNITREP, it seems that the Marine Corps does not use it as they should. UNITREP has become a report on the commander--from the commander . . . (Captain, 7538).
- The only real tangible feeling for combat readiness is MCCRES (Captain, 7562).
- UNITREP is inadequate. The system as is, is often abused. Reporting units often inflate or reduce figures to affect an unrelated decision or to bring attention to particular problems. Higher headquarters often attempt to coerce reporting units into changing figures . . . or ignores trends until C-3 or C-4 is reached . . . (Captain, 0302).
- UNITREP reporting does a reasonable job of controlling the flow of men and resources (Major, 0302).

- The problem with UNITREP is integrity of reporting . . . we have a significant problem in reporting honestly, any case of degraded readiness Those units with problems must find it acceptable to report it the way it is, without the C.O. being fired, if there are valid shortfalls (Major, 7562).
- Suggest you survey rifle battalion and regimental FMF commanders. NPS officers are not qualified to answer these questions (Major, 0302). (Note: I concur with part one only--see recommendations for further study.)
- To me, all the factors you listed are important and the importance varies only by a degree (Captain, 0180).
- The list seems very complete. A factor I would add is "how long have the Marines that you are taking into battle been in their present units?" Did you get them as you stepped on the boat or did you train them yourself (Captain, 0302)?
- To me, the levels of personnel and equipment readiness go hand and glove Whether a C-1 status in all areas would be required depends upon what the mission would be I feel the quantitative measures of UNITREP are good measures of combat readiness . . . but many qualitative measures are also very important and not reflected to the degree they should or could be, i.e., quality of small unit training, strengths of the C.O., continuity of the unit, morale, etc. (Captain, 3002).

2. Personnel

- Perhaps another personnel factor should be added, i.e., "service experience in MOS." Many Marines who have an MOS on paper have served in other billet MOS's more than in their primary MOS (Captain, 0302).
- Another personnel factor is needed, i.e., "unit stability (turnover rate)" (Captain, 0402).
- It is more important to have good people as opposed to numbers of people (Captain, 0802).
- . . . experienced technicians are critical when you are in a fixed wing unit (Captain, 7588).
- Add under personnel, "identification and training of replacement personnel" (LT, USN, Medical Service Corps).

3. Equipment and Supplies

- Any commander would want every possible means of support and supply available for combat. Regardless, the key to success in combat is built on what you do with your resources . . . this is entirely a matter of control (Major, 0302).
- . . . the deficiency most often noted by MAU and MAB commanders, when deploying, was a lack of equipment (both quantity and quality). The MAF and FSSG answer was "don't worry, we will get you the equipment before you have to go to war." Yet, the how was never explained (Captain, 0302).
- . . . spare parts and an intermediate repair facility are critical when you are in a fixed wing unit . . . (Captain, 7588).
- If a unit is on its own for 15 days, this would be a come as you are affair. Any resupply would be air drop or fly away. In other words, the unit would have to get in, kick ass and get out (LCDR, USN, Medical Service Corps).
- Add under supplies, "identification of replacement equipment and supplies" and "recent validation of equipment and supply items to scenarios likely to be encountered" (tie into intelligence) (LT, USN, Medical Service Corps).

4. Equipment Condition

- Training on existing systems and equipment is more important than modernization . . . people need to work with their equipment and maintain it better (Major, 2502).
- I would rather go into the field with older, proven equipment that more people have more experience with than a bunch of new crap that is going to break and be difficult to fix (Lieutenant Colonel, 7562).
- Under the present system of aviation supply support of MAU operations, an aviation unit would be hard pressed to maintain OP-ready aircraft during a 15 day deployment without some link to a ship's maintenance and supply activities. The result is a squadron is unable to operate independently of its support vessel and requires the ship to remain in close proximity of the

battlefield. This has been found to be a weak link in attempting extended MAU operations ashore (Captain, 3060).

- Equipment should not be antiquated, i.e., tubes in a transistor world, but proficiency with what we have is critical (Captain, 2502).

5. Training

- With respect to training--a unit is only as good as its weakest link. If your individual Marines don't have confidence in their ability to fight, based upon their individual combat skills, then leadership will not be able to overcome this deficiency (Lieutenant Colonel, 0302).
- Specification of unit training scenario is needed to improve this model, i.e., company operations are more difficult in Panama or Germany, than at Camp Lejeune, N.C. At Camp Lejeune the Marines are more aware of the terrain (Captain, 0302).
- The worst problem we had at my unit was the absolute lack of individual, crew or platoon training. We were CGed and IGed to death. As far as senior officers went, their emphasis was on dog and pony shows or anything else political as opposed to training. I hope and pray that when you get to HQMC, that you will help get everyone oriented to doing individual and small unit training. Also, tell them to stop sending politicians to Camp _____. Send them to Quantico, in that they have no business interrupting training in the FMF (Captain, 1802).
- If I had to pick a top priority of the factors listed, it would be training (Captain, 0302).
- In regards to training, all future contingencies will be in a joint arena. This training cannot be overemphasized (Captain, 0402)!

6. C4

- Leadership "style" is far less important than the "quality" of leadership in terms of getting the job done (Colonel, 9907).
- Combining C3 with climate is not logical (Colonel, 9906). (Note: In hindsight, I concur.)

- Commanding officers who possess poor judgement should not be there to begin with (Lieutenant Colonel, 7511)!
- . . . going into combat by order of priorities: 1) self control, 2) familiarity with chain of command, 3) best intelligence possible, 4) best equipment possible, and 5) best training for individuals/units possible (Major, 0302).
- I would additionally consider the capabilities and experience of middle management (i.e., Captains, Majors, SNCO's, NCO's, etc.) to be of prime importance. With good and strong middle management a lot of C.O. shortcomings can be overcome (Lieutenant Colonel, 7562).
- On C.O.'s judgement--too many items are micro-managed today, to the extent that the C.O. has become only a messenger. In Lebanon, the JCS was calling once a day giving "advice" and orders. Maybe this was just a unique situation (Major, 7564).
- Commanding Officer's judgement--a crystal ball--subjective at best (Captain, 3002).

IX. RECOMMENDATIONS FOR FURTHER STUDY

Listed below are some of thoughts on the conduct of this study and suggestions for further research:

A. SURVEY SAMPLING

Any follow-on of this study, or a similar project, should include input from the Staff Noncommissioned officer and Noncommissioned officer communities. The experience and opinions of this superb group of individuals are most valuable to our Corps.

Any follow-on of this study, or a similar project, should include input from personnel currently serving in MAFs, MABs, MAUs or FMF units.

B. READINESS DIMENSIONS USED

An expanded analysis of readiness via Bootstrapping could be a rewarding and interesting project. For example, Readiness as a function of resources (UNITREP) + operational capabilities (MCRESS) + other factors, could provide a more complete analysis of readiness of a MAGTF.

C. METHODOLOGY

Any individual or group considering the conduct of a similar project should consider using the EXPERT77 software package. That is, most people I have observed using

EXPERT77 have enjoyed their interaction with this software package. As mentioned earlier, EXPERT77 can facilitate a considerable savings of time for anyone conducting a like research project. That is, the data collection and statistical analysis phase could be self-contained in this unique product.

EXPERT77 (or manual Bootstrapping) can assist any organization in the development of criteria of any kind.

D. BOOTSTRAPPING APPLICATIONS

Bootstrapping can be applied to:

- Help organizations better understand their purpose(s).
- Development of generalized systematic modeling of organization effectiveness.
- Obtaining a strategic understanding of effectiveness.
- Consensus generation
- Development of management information systems to support control systems.
- Guide analysts in the design of research on resources to readiness.
- Develop productivity measurements in respect to the importance of results divided by resources.
- Orientation and training of critical factors of success.

Anytime an organization devotes time to answering the question what is "effectiveness"?, is time well spent. The application of Bootstrap in the pursuit of "effectiveness" offers considerable potential for organizations interested in explicating effectiveness.

In that pursuit of effectiveness is an on-going part of an organization, Bootstrapping can be used to identify changes occurring due to environmental considerations.

APPENDIX A

INITIAL READINESS MODEL DEVELOPMENT AND RESULTS--A MAGTF WITHIN AN ATF

In that a NPS group project model used to evaluate Amphibious Task Force readiness was the foundation from which this study's final model was developed, it will be briefly explained. The ATF group was composed of three Navy surface line officers (all with amphibious squadron experience) and myself (who had experienced two sea deployments). My group's final ATF model was developed with objectives to: 1) focus on matters relating only to "readiness" and 2) include only factors that recommended measurements could be developed for. At the outset of our ATF readiness model development, the group's consensus was that UNITREP was an inadequate measure of ATF readiness. Yet, by default our ATF readiness model (developed by brainstorming and a modified Delphi process [Ref. 16] related closely to the readiness factors in UNITREP. My group's ATF readiness model, of which a MAGTF is a major element thereof, included personnel, equipment, training and command/control as major factors--differing from UNITREP by command/control (ATF model) and equipment and supplies on hand (UNITREP).

My group's final model is depicted as follows:

- ATF Readiness = Personnel readiness + equipment readiness + training readiness + command/control readiness;
- Personnel Readiness = % manning level of personnel on hand + the experience level of personnel on hand + command climate (morale);
- Equipment Readiness = Material condition + material level + modernization + ship type + ship to shore capabilities;
- Training Readiness = Navy unit training + Marine unit training + joint Navy/Marine exercise training;
- Command/Control Readiness = Communication readiness + intelligence readiness + Navy/Marine coordination readiness + scenario.

By using a personal computer software package (based upon Bootstrap methodology) developed by COGITON called EXPERT77 (See Appendix G) the values of importance of the above factors were computed as shown below:

<u>Overall Factors</u>	<u>Weight Assigned</u>	<u>Group R²</u>
- Personnel	.2825	.95
- Command/Control	.2575	
- Equipment	.2450	
- Training	.2375	
 <u>Personnel Factors</u>		
- % Manning Level	.5025	.94
- Experience Level	.2975	
- Command Climate	.2000	
 <u>Command/Control Factors</u>		
- Communications	.3350	.93
- Navy/Marine Coordinates	.3000	
- Intelligence	.1925	
- Scenario	.1700	

Equipment Factors

- Material Conditions	.3075	.89
- Ship to Shore Capabilities	.2600	
- Material Level	.2150	
- Modernization	.1100	
- Ship Type	.0625	

Training Factors

- Joint Navy/Marine Exercises	.4175	.96
- Marine Unit Training	.3250	
- Navy Unit Training	.2575	

NOTES:

- 1) The above ATF readiness factors are listed in sequence of the group's average value of importance.
- 2) The group's average value is the normalized weight of the group's overall value judgements.
- 3) See Appendix F for computational explanations of the group's normalized weight and R square value.

APPENDIX B

NPS MAGTF COMBAT READINESS MODEL DEVELOPMENT AND RESULTS

At the conclusion of the group project referred to in Appendix A, I in conjunction with my thesis advisors, decided: 1) to use Bootstrapping methodology to further investigate only MAGTF combat readiness and 2) to gain approval to survey selected officers at HQMC and MCDEC. Subject commands were selected as survey sites because they allowed efficient access to officers with air, ground and combat service support experience. In respect to MCDEC, approval was obtained to survey officers at the U.S. Marine Corps Command and Staff College (C&SC) and Amphibious Warfare School (AWS).

Yet, before heading off to HQMC, I desired to build a MAGTF combat readiness model that contained the value judgements of as many Marine officers as possible. Accordingly, the survey package contained in Appendix C was developed. Subject survey was sent to 89 Marine officers at NPS and 45 surveys were completed and returned. (Note: two of the 45 surveys were completed by Navy Medical Service Corps officers with each having over 10 years of duty with the Marine Corps.)

No fancy or complicated statistical method was used to compile the results of this survey. My intention was only to seek recommendations for additions, deletions or modifications to the model I had developed.

The responses provided for the MAGTF combat readiness model factors and the numeric value of each response were as follows:

<u>Term</u>	<u>Abbreviation</u>	<u>Value</u>
Not Important	NI	0
Somewhat Important	SI	1
Important	I	2
Very Important	VI	3

My goal in this survey was to be able to go to HQMC and MCDEC with a MAGTF combat readiness model that included only important factors for consideration. By computing group averages of the individual responses to the 45 surveys completed I was able to achieve this goal. The maximum average value of any factor was 3 (VI). I made an arbitrary decision that for a factor to be included in the final survey model, it would need an average group response of 1.75. That is, I wanted all factors to be close to or greater than a group average of 2 (I). Listed below are the results of the NPS MAGTF model survey:

Personnel FactorsAverage Value

- % of Critical MOSs	2.82
- % > E-5 Billets	2.70
- Experience Level	2.56
- % Manning Level	2.56
- Combat Experience	1.64

Equipment and Supplies

- % Equipment	2.82
- % Supplies	2.79

Equipment Conditions

- % Equipment Combat Ready	2.97
- % End Items Combat Ready	2.61
- Modernization	1.91

Training

- Joint Air, Ground and Combat Service Support	2.59
- Individual Skills	2.56
- % Combat Ready Air Crews	2.47
- % Unit Training Completed	2.41
- Weeks Training Required	2.25
- USMC/Navy Training	2.24

Other

- Command, Control and Communication	2.80
- Intelligence	2.76
- CO's Judgement	2.66
- Command Climate	2.59
- CO's Leadership	1.91

NOTES:

- 1) The values for each factor are simply the average value of 45 NPS officer respondents, with a maximum value possible of 3.
- 2) Factors are listed in sequence of high to low average value within each major category.

- 3) No computations were obtained for the overall values, i.e., personnel equipment and supplies (quantity), equipment condition, training and other.

Based upon the numeric averages listed above and upon recommended modifications from the NPS officer respondents, I made the following modifications to the subject model:

- Having personnel with combat experience was deleted due to its low group average value and comments relating that having such personnel would not be likely at the MAGTF combat element level.
- In regards to unit training factors, only "percent unit training completed" was retained in that it could be more easily related to each major element of a MAGTF. This was an error in judgement by the author, in that subsequent research revealed that "weeks of training" is the primary criteria used in reporting USMC UNITREP training data.
- "Command climate" was redesignated to "unit morale".
- "Commanding officer's leadership style" was expanded to that of "unit leadership".

Basic information on the NPS officers who provided input to help me build my final model is as follows:

	<u>Air</u>	<u>Ground</u>	<u>CSS</u>	<u>Total</u>
LTCOL	1	0	0	1
MAJ/LCDR	3	4	5 (*)	12
CAPT/LT	9	12	8 (*)	29
1st LT	0	2	1	3
TOTAL	13	18	14	<u>45</u>

(*) = One Navy Medical Service Corps Officer, both of whom had combat tours with the Marines in Vietnam.

APPENDIX C

NPS MAGTF COMBAT READINESS SURVEY

This appendix contains the survey package that was conducted at the NPS from 19 August until 6 September 1985.

19 August 1985

From: Major Paul R. Stahl
To: Fellow Naval Postgraduate School Marine
Subj: Thesis Help and Advice, request for
Encl: (1) MAGTF Combat Readiness Questionnaire

1. Can the factors that make a Marine Air-Ground Task Force (MAGTF) combat ready be segregated and assigned values of importance? Do the factors that make the elements of MAGTF combat ready differ by type of element, i. e. ground, air and combat service support? Are the factors of readiness in UNIREP adequate measures of combat readiness of a MAGTF? These questions represent the general thrust of the research I have chosen for my graduate thesis. The purpose of this letter is to introduce myself and request your assistance.

2. I am a student in the Manpower, Personnel and Training Analysis Curriculum. After graduation I am slated for duty with the Plans and Policy Division, Manpower Department, HQMC. My thesis topic is "In Search of Combat Readiness in the U. S. Marine Corps." The enclosure is provided to obtain your expert opinion on my topic.

3. Consider yourself assigned to an appropriate billet of a Marine Amphibious Brigade (MAB). You are either afloat or in an alpha air alert status. Our national leaders have determined it necessary to project power ashore in a hostile region. The word has come down to "land the landing force" or "fly away". You know that your unit could be on its own for up to 15 days possibly. What would you want to see, hear or have available in your unit at this time? The combat readiness ratings of your unit prior to the above situation could be a factor in regards to the resources available to your unit.

5. With the above thoughts in mind please complete the enclosure and return to me in the envelope provided. For your input to be considered please return by Friday, 6 September 1985.

Semper FI,

Paul R. Stahl
Paul R. Stahl

MAGTF COMBAT READINESS QUESTIONNAIRE

Please circle the most applicable response:

Not Important	NI
Somewhat Important	SI
Important	I
Very Important	VI
Modify As Indicated	MOD

Personnel:

-Percent fill of manning level?

NI SI I VI MOD

-Percent fill of critical MOSs?

NI SI I VI MOD

-Percent fill of critical E-5 and above billets?

NI SI I VI MOD

-Experience level of personnel on-hand?

NI SI I VI MOD

-Having personnel with combat experience on-hand?

NI SI I VI MOD

Equipment and Supplies (Quantity):

-Percent fill of required equipment?

NI SI I VI MOD

-Percent fill of required end items, support equipment and supplies?

NI SI I VI MOD

Equipment (quality):

-Percent fill of combat-essential equipment possessed and combat ready?

NI SI I VI MOD

-Percent fill of major end items possessed and combat ready?

NI SI I VI MOD

-Modernization of equipment on-hand?

NI SI I VI MOD

Training:

-Weeks of Training required?

NI SI I VI MOD

-Percent of combat-ready air crews?

NI SI I VI MOD

-Percent of unit training completed?

NI SI I VI MOD

-Individual skills training?

NI SI I VI MOD

-Joint air, ground and service support training?

NI SI I VI MOD

-Joint USMC MAGTF and Navy Training?

NI SI I VI MOD

Other:

-Command climate (to include morale)?

NI SI I VI MOD

-Commanding officer's judgement abilities?

NI SI I VI MOD

-Commanding officer's leadership style?

NI SI I VI MOD

-MAGTF command, communications and control capabilities?

NI SI I VI MOD

-MAGTF intelligence capabilities?

NI SI I VI MOD

What factors would you want to add to the above list?

Name (Optional): _____

Rank: _____ Primary MOS: _____

Years of service: _____

Prior enlisted (Yes/No): _____

Combat experience (Yes/No): _____

If yes where? _____

My experience has primarily been with with the following types of units (circle one please):

Air Ground Serv/Spt Other (Please state)

I have primarily served on (circle one please):

East coast West coast
Overseas (If so where?)
Other (Please state)

Any other comments you would like to make:

APPENDIX D

HQMC AND MCDEC MAGTF COMBAT READINESS SURVEY VIA BOOTSTRAPPING

This appendix contains the survey package administered to officers at HQMC and MCDEC from 19 to 26 September 1985.

NAVAL POSTGRADUATE SCHOOL
THESIS SURVEY

"IN SEARCH OF COMBAT READINESS IN THE U. S. MARINE CORPS"

A LOOK AT THE MOST SIGNIFICANT FACTORS THAT MAKE
A MARINE CORPS AIR-GROUND TASK FORCE COMBAT READY

Major Paul R. Stahl, USMC
Manpower, Personnel and Training Analysis Curriculum
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Autovon 878-2536/2537
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SMC Box 1104
Monterey, California 93943

BACKGROUND AND GENERAL INFORMATION

Can the factors that make a Marine Air-Ground Task Force (MAGTF) combat ready be segregated and assigned values of importance? Do the factors that make the elements of MAGTF combat ready differ by type of element, i. e. ground, air and combat service support? Are the factors of readiness in UNITREP adequate measures of combat readiness of a MAGTF? These questions represent the general thrust of the research I have chosen for my graduate thesis. The purpose of this survey is to request your expert opinions.

Please do not panic at the size of this survey package. The combat readiness model developed for your analysis was derived from a survey of 40 Marine officers at the Naval Postgraduate School. It consists of five major combat readiness dimensions. To obtain statistical significance from the methodology I will use for my analysis, data from 21 profiles of each major dimension is required. Due to paper size constraints, each page of this survey contains only one, three or four profiles as appropriate.

Consider yourself assigned to an appropriate billet of a Marine Amphibious Brigade. You are either afloat or in an alpha air alert status. Our national leaders have determined it necessary to project power ashore in a hostile region. The word has come down to "land the landing force" or "fly away". You know that your unit could be on its own for up to 15 days possibly. What would you want to see, hear or have available in your unit at this time? The combat readiness ratings of your unit prior to the above situation could be a factor in regards to the resources available to your unit.

With the above thoughts in mind please complete the following survey. NOTE: IN REGARDS TO THE ASSESSMENT SCALES PROVIDED, YOU ARE NOT RESTRICTED TO RANKING A PROFILE AS 10, 20, 30, ETC. YOU CAN USE ANY INTEGER FROM 1 TO 99, i. e. 23, 55, 79, ETC.

BASIC DESCRIPTIONS OF READINESS MODEL DIMENSIONS

PERSONNEL:

Percent Manning Level: Refers to total available strength divided by structured strength.

Percent Critical MOSSs: Refers to service-selected critical MOSSs of available strength divided by structured strength of critical MOSSs.

Percent E-⁵/₄s and Above: Refers to grade fill of service-selected critical sergeants and above available divided by structured strength of critical sergeants and above.

Service Experience: Refers to the experience of key officer and enlisted personnel in MAGTF units. Relates to how long they have served in the type of billet and unit they are assigned to.

EQUIPMENT AND SUPPLIES:

Percent Equipment: Refers to service selected combat-essential equipment possessed divided by prescribed wartime requirements.

Percent Supplies: Refers to service-selected end items, support equipment and supplies possessed and divided by prescribed wartime requirements

EQUIPMENT CONDITION:

Percent Equipment Combat Ready: Refers to service-selected combat-essential equipment possessed and combat ready divided by prescribed wartime requirements.

Percent End Items Combat Ready: Refers to major service-selected end items of equipment possessed and combat ready divided by prescribed wartime requirements.

Modernization: Refers to the technical capabilities of on-hand equipment. Relates to whether or not the unit possesses state of the art equipment.

TRAINING:

Individual Skills Training: Refers to the capabilities of individuals to perform skills required by their MOS.

Percent Unit Training Completed: Refers to the proficiency level of air, ground and service support units. Relates to the capabilities of air crews, infantry small units, maintenance teams, howitzer crews, tank crews, radio operators, etc.

(Note: UNITREP gives the option of reporting either "weeks of training, or percent of unit training completed, or percent of combat ready air crews." For the purpose of this survey I have chosen to include only the above category in that it can be related to each major component of a MAGTF.)

Joint MAGTF Element Training: Refers to the capability of MAGTF elements to function as a coordinated air-ground team.

MAGTF and Navy Training: Refers to the capabilities of the MAGTF to embark, debark and coordinate operations ashore within a naval amphibious task force environment.

COMMAND, CONTROL, COMMUNICATIONS (C3) AND UNIT CLIMATE:

Unit Morale: Refers to the motivation of personnel in regards to their unit and mission.

Unit Leadership: Refers to the leadership style of unit commanders and personnel in other key billets.

Command, Control and Communications: Refers to the abilities of the MAGTF and element staffs to command, control and communicate to units under their cognizance. Relates to the concepts of fire support coordination, teamwork, equipment interfacing, etc.

Intelligence: Refers to the intelligence gathering and analysis capabilities of MAGTF and element staffs.

Commanding Officer's Judgement: Refers to MAGTF and element commanders decision making abilities.

PERSONNEL PROFILES

ASSESSMENT OF PERSONNEL:

EACH PROFILE YOU SEE PORTRAYS AN ALTERNATIVE IN TERMS OF THE DIMENSIONS OR ATTRIBUTES OF MAGTF COMBAT READINESS EARLIER DEFINED.

CONSIDERING JUST THE INFORMATION YOU WILL BE SHOWN, WHAT IS YOUR ASSESSMENT OF PERSONNEL OVERALL?

RELY UPON YOUR OWN KNOWLEDGE AND INTUITION TO RATE OVERALL PERSONNEL. USE THE RATING SCALE THAT WILL APPEAR AT THE BOTTOM OF EACH PROFILE. NOTE THE DESCRIPTIONS GIVEN AS REFERENCE FOR THIS SCALE.

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSS	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSS	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSS	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSSs	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSSs	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
PERCENT CRITICAL MOSSs	1	2	3	4	5 6 7 8 9
PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
PERCENT MANNING LEVEL	1	2	3	4	5 6 7 8 9
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PERCENT E-5s AND ABOVE	1	2	3	4	5 6 7 8 9
SERVICE EXPERIENCE	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF PERSONNEL.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				Marginal		SAT		

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EQUIPMENT AND SUPPLIES PROFILES

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 UNSAT MARGINAL SAT

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MODERNIZATION	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF EQUIPMENT CONDITION.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT			MARGINAL			SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR				
% EQUIP COMBAT READY	1	2	3	4	5	6	7	8	9
% END ITEMS CBT READY	1	2	3	4	5	6	7	8	9
MODERNIZATION	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF EQUIPMENT CONDITION.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT			MARGINAL			SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR				
% EQUIP COMBAT READY	1	2	3	4	5	6	7	8	9
% END ITEMS CBT READY	1	2	3	4	5	6	7	8	9
MODERNIZATION	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF EQUIPMENT CONDITION.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT			MARGINAL			SAT		

TRAINING PROFILES

ASSESSMENT OF TRAINING:

EACH PROFILE YOU SEE PORTRAYS AN ALTERNATIVE IN TERMS OF THE DIMENSIONS OR ATTRIBUTES OF MAGTF COMBAT READINESS EARLIER DEFINED.

CONSIDERING JUST THE INFORMATION YOU WILL BE SHOWN, WHAT IS YOUR ASSESSMENT OF TRAINING OVERALL?

RELY UPON YOUR OWN KNOWLEDGE AND INTUITION TO RATE OVERALL TRAINING? USE THE RATING SCALE THAT WILL APPEAR AT THE BOTTOM OF EACH PROFILE. NOTE THE DESCRIPTIONS GIVEN AS REFERENCE FOR THIS SCALE.

	BELOW	STND	MIN	ABOV	SUPERIOR
INDIV SKILLS TNG	1	2	3	4	5 6 7 8 9
% UNIT TNG COMPLETED	1	2	3	4	5 6 7 8 9
JOINT MAGTF TNG	1	2	3	4	5 6 7 8 9
MAGTF/NAVY TNG	1	2	3	4	5 6 7 8 9

ENTER YOUR ASSESSMENT OF TRAINING.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
INDIV SKILLS TNG	1	2	3	4	5 6 7 8 9
% UNIT TNG COMPLETED	1	2	3	4	5 6 7 8 9
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ENTER YOUR ASSESSMENT OF TRAINING.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL		SAT		

	BELOW	STND	MIN	ABOV	SUPERIOR
INDIV SKILLS TNG	1	2	3	4	5 6 7 8 9
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ENTER YOUR ASSESSMENT OF TRAINING.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL		SAT		

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ENTER YOUR ASSESSMENT OF TRAINING.

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	UNSAT				MARGINAL			SAT	

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	UNSAT				MARGINAL			SAT	

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USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

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C3 AND COMMAND CLIMATE PROFILES

ASSESSMENT OF C3 AND COMMAND CLIMATE:

EACH PROFILE YOU SEE PORTRAYS AN ALTERNATIVE IN TERMS OF THE DIMENSIONS OR ATTRIBUTES OF MAGTF COMBAT READINESS EARLIER DEFINED.

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	BELOW STND				MIN	ABOV	SUPERIOR		
UNIT MORALE	1	2	3	4	5	6	7	8	9
UNIT LEADERSHIP	1	2	3	4	5	6	7	8	9
CMD, CNTL AND COMM	1	2	3	4	5	6	7	8	9
INTEL CAPABILITIES	1	2	3	4	5	6	7	8	9
CO's JUDGEMENT	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF C3 AND COMMAND CLIMATE.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
UNIT MORALE	1	2	3	4	5	6	7	8	9
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 UNSAT MARGINAL SAT

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UNIT LEADERSHIP	1	2	3	4	5	6	7	8	9
CMD, CNTL AND COMM	1	2	3	4	5	6	7	8	9
INTEL CAPABILITIES	1	2	3	4	5	6	7	8	9
CO's JUDGEMENT	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF C3 AND COMMAND CLIMATE.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

MAGTF COMBAT READINESS PROFILES

ASSESSMENT OF MAGTF COMBAT READINESS:

EACH PROFILE YOU SEE PORTRAYS AN ALTERNATIVE IN TERMS OF THE DIMENSIONS OR ATTRIBUTES OF MAGTF COMBAT READINESS EARLIER DEFINED.

CONSIDERING JUST THE INFORMATION YOU WILL BE SHOWN, WHAT IS YOUR ASSESSMENT OF MAGTF COMBAT READINESS OVERALL?

RELY UPON YOUR OWN KNOWLEDGE AND INTUITION TO RATE OVERALL MAGTF COMBAT READINESS. USE THE RATING SCALE THAT WILL APPEAR AT THE BOTTOM OF EACH PROFILE. NOTE THE DESCRIPTIONS GIVEN AS REFERENCE FOR THIS SCALE.

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
EQUIPMENT CONDITION	1	2	3	4	5	6	7	8	9
TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
EQUIPMENT CONDITION	1	2	3	4	5	6	7	8	9
TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
EQUIPMENT CONDITION	1	2	3	4	5	6	7	8	9
TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
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TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL			SAT	

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
EQUIPMENT CONDITION	1	2	3	4	5	6	7	8	9
TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL			SAT	

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
EQUIPMENT CONDITION	1	2	3	4	5	6	7	8	9
TRAINING	1	2	3	4	5	6	7	8	9
C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE:

10	20	30	40	50	60	70	80	90
UNSAT				MARGINAL			SAT	

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
EQUIPMENT AND SUPPLIES	1	2	3	4	5	6	7	8	9
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ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
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ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW	STND	MIN	ABOV	SUPERIOR				
PERSONNEL	1	2	3	4	5	6	7	8	9
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	BELOW	STND	MIN	ABOV	SUPERIOR				
PERSONNEL	1	2	3	4	5	6	7	8	9
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	BELOW	STND	MIN	ABOV	SUPERIOR				
PERSONNEL	1	2	3	4	5	6	7	8	9
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	BELOW STND				MIN	ABOV	SUPERIOR		
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TRAINING	1	2	3	4	5	6	7	8	9
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	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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	BELOW STND				MIN	ABOV	SUPERIOR		
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	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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PERSONNEL	1	2	3	4	5	6	7	8	9
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TRAINING	1	2	3	4	5	6	7	8	9
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 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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TRAINING	1	2	3	4	5	6	7	8	9
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USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

	BELOW STND				MIN	ABOV	SUPERIOR		
PERSONNEL	1	2	3	4	5	6	7	8	9
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C3 AND CLIMATE	1	2	3	4	5	6	7	8	9

ENTER YOUR ASSESSMENT OF MAGTF COMBAT READINESS.

USE THIS SCALE: 10 20 30 40 50 60 70 80 90
 UNSAT MARGINAL SAT

RESPONDENT INFORMATION

Name (Optional): _____

Rank: _____ Primary MOS: _____

Years of service: _____

Prior enlisted (Yes/No): _____

Combat experience (Yes/No): _____

If yes where? _____

My experience has primarily been with the following types of units (circle one please):

Air Ground Cbt Serv/Spt Other (Please state)

I have primarily served on (circle one please):

East coast West coast

Overseas (If so where?)

Other (Please state)

What factors would you want to add to the above model?

Please provide any other comments you would like to make in response to this survey.

THANKS MUCH FOR YOUR INPUT AND TIME!

APPENDIX E

RANDOM NUMBER DATA USED FOR THE COMBAT READINESS PROFILES AND THE SAS PROGRAM USED TO CREATE IT

This appendix contains the random number data set used to create the profiles contained in Appendix D. The actual SAS output document [Ref. 15] contained additional statistical output data, to include a 10 x 20 data set of random variables. Yet, in that I only used the first five columns of subject data set, only those numbers used are displayed. Additionally, the SAS program that created this data set (written by Professor Paul J. Hoffman) is provided. (Note: If a profile had two variables to assess, I used only columns 1 and 2; if it had three variables, I used columns 1 to 3; etc.)

A. RANDOM NUMBER DATA SET USED TO CREATE READINESS PROFILES IN APPENDIX D

	COL 1	COL 2	COL 3	COL 4	COL 5
ROW 1	5	6	4	3	4
ROW 2	5	3	3	5	4
ROW 3	6	7	6	2	2
ROW 4	7	3	6	2	6
ROW 5	3	5	4	2	4
ROW 6	5	5	1	4	6

ROW 7	8	7	7	5	6
ROW 8	5	6	5	8	6
ROW 9	5	6	4	4	9
ROW 10	2	2	6	7	4
ROW 11	4	4	5	5	6
ROW 12	5	5	7	5	7
ROW 13	8	5	2	8	3
ROW 14	8	3	8	7	3
ROW 15	6	7	4	5	2
ROW 16	3	3	6	4	3
ROW 17	6	5	4	4	7
ROW 18	2	9	7	6	5
ROW 19	6	3	6	6	6
ROW 20	4	7	4	7	6
* 21	5	8	6	5	5

Note: (*) = a random row of numbers from column 6 to 10 (not shown). These numbers were going to be used for a consistency check, yet this procedure was not conducted for this study.

B. SAS PROGRAM USED TO CREATE RANDOM NUMBER DATA SET

```

//KAISER5=JOB (2351,1104),'KAISER4',CLASS=A
//MAIN ORG=NP GVM1.2351P
// EXEC SAS
//SAS.WORK DD SPACE=(CYL,(10,10))
//SYSIN DD =
*****PRODUCES A SCORE MATRIX WHOSE CORRELATION MATRIX IS YOUR HEART'S DESIRE.;
***** ROUTINE FOR ENTERING YOUR DESIRED CORRELATION MATRIX.;
***** IN THIS EXAMPLE, WE ARE USING A 5-VARIABLE MATRIX. USE YOUR OWN.;
DATA CORRMATR(TYPE=CORR);
INPUT (A B C D E F G H I J)(7.5);
TYPE='CORR';
LENGTH NAME $ 9.;
IF _N_=1 THEN _NAME_='A';
IF _N_=2 THEN _NAME_='B';
IF _N_=3 THEN _NAME_='C';
IF _N_=4 THEN _NAME_='D';
IF _N_=5 THEN _NAME_='E';
IF _N_=6 THEN _NAME_='F';
IF _N_=7 THEN _NAME_='G';
IF _N_=8 THEN _NAME_='H';
IF _N_=9 THEN _NAME_='I';
IF _N_=10 THEN _NAME_='J';
CARDS;
1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000
PROC PRINT;
*****FINDS ALL PRINCIPAL COMPONENTS OF YOUR CORRELATION MATRIX.;
PROC FACTOR DATA = CORRMATR(TYPE=CORR) MINEIGEN=.001 OUTSTAT=STATS;
PROC MATRIX;
FETCH FACT DATA=STATS(TYPE=FACTOR);
PRINT FACT;
*****ENTER YOUR OWN VALUES FOR N (NO. OF OBS) AND M (NO. OF VARS) HERE.;
** M MUST MATCH THE NO. OF ROWS AND COLS OF YOUR CORRELATION MATRIX.;
** ENTER YOUR OWN DESIRED VALUES FOR MEANS AND STD'S OF THE VARIABLES.;
** IN THIS VERSION OF THE PROGRAM, ALL VARIABLES WILL HAVE EQUAL MEANS & SDS.
;
M=10; N=20;MEAN=5; SD=1.3;
J1= 3 + M + 3 + 1;
J2= J1 + (M - 1);
CONSTS = J.(6,1,0);
CONSTS(1,)= N; CONSTS(2,)= M; CONSTS(3,)=J1; CONSTS(4,)=J2;
CONSTS(5,)= MEAN; CONSTS(6,)= SD;
F=FACT(J1:J2, 1:M);
F=F';
PRINT F; OUTPUT F OUT = F;
* COMMENT NOW CREATE A MATRIX OF RANDOM NORMAL DEVIATES, EXACTLY (0,1);
X=J.(M,N);
DO I=1 TO M; DO J=1 TO N;
X(I,J)=NORMAL(0); END; END;
X=X';
OUTPUT X OUT = XRAND;
OUTPUT CONSTS OUT = CONSTS;
PROC STANDARD DATA= XRAND OUT = ZSCORES MEAN = 0 STD = 1;
PROC MATRIX;
FETCH CONSTS DATA = CONSTS;
N=CONSTS(1,); M=CONSTS(2,); MEAN=CONSTS(5,);SD=CONSTS(6,); PRINT CONSTS;
FETCH Z DATA = .ZSCORES;
Z=Z';
*****GENERATES A SCORE MATRIX (Z-SCORES) WHOSE INTERCORRELATIONS ARE ALL ZERO.;
FETCH F DATA = F;
XX = Z*Z';
EIGEN EVALS EVECS XX;
EVALS=DIAG(EVALS);
EVALS = ABS(EVALS);

```

```

MROOT=EVALS ##(-.5);
PRINT EVECS; PRINT EVALS; PRINT MROOT;
SQN=N ##(.5);
NOTE THESE ARE ORTHOGONAL VARIABLES, IF YOU WISH TO USE THEM.;
ZORTHOG=MROOT*EVECS'*Z*SQN; ZORTHOG=ZORTHOG'; PRINT ZORTHOG;
****FINALLY, PRODUCES THE DESIRED SCORE MATRIX AS ZWANTED.;
****YOU CAN SUBJECT THE COLUMNS TO LINEAR TRANSFORMS, AS YOU WISH.;
PAGE;
NOTE THIS IS YOUR DESIRED SET OF VARIABLES;
NOTE ALGORITHM BY HANK KAISER-- IMPLEMENTED IN SAS BY PAUL J. HOFFMAN;
ZWANTED=F*ZORTHOG'; ZWANTED=(SD*ZWANTED+MEAN)'; PRINT ZWANTED;
ZWANTED=INT(ZWANTED+.5); PRINT ZWANTED;
OUTPUT ZORTHOG OUT = ZORTHOG; OUTPUT ZWANTED OUT=ZWANTED;
PROC CORR DATA = ZWANTED NOPROB;
TITLE INTERCORRELATIONS OF YOUR DESIRED DATA SET. CHECK THEM YOURSELF ;
TITLE1 "SD'S ARE POPULATION ESTIMATES.";
TITLE2 "MULTIPLY BY (N-1)/N TO SEE THAT THEY ARE DESIRED STD'S.";

```

APPENDIX •F

STATISTICAL TERMS, FORMULATIONS, AND SAS PROGRAMS USED FOR DATA ANALYSIS

The information in this appendix is intended to provide only a basic understanding of the statistical concepts, Bootstrap methodology, and SAS programs used for data analysis. Due to the complexity of the processes used, I will attempt to describe only necessary terms and formulations. Accordingly, only examples of the many repetitive processes used will be given.

A. BASIC REVIEW OF STATISTICAL TERMS

Provided below are some basic definitions of terms that should be helpful: [Ref. 19]

- Statistics: Refers to the collection, presentation, analysis, and utilization of numerical data to make inferences and reach decisions in the face of uncertainty.
- Inferential Statistics: Refers to the process of reaching generalizations about the whole (called the population) by examining a portion (called the sample). In order for this job to be valid, the sample must be representative of the population.
- Regression Analysis: Refers to the relationship between one variable to be explained (the dependent variable Y) and one or more explanatory (or independent X) variables. When there is only one independent variable (X), you have simple regression. When you have more than one independent variable (X), you have multiple regression.

- Linear Regression Analysis: Refers to an assumption that there is an approximate linear relationship between X and Y. That is, if the value of X was plotted in reference to the value of Y, the values of X and Y would fall on or near a straight line.
- Coefficients (B): Refers to parameter estimates of the independent variables. That is, an estimate (\hat{b}_N) measures the change in (Y) for a unit change in (X_N), while holding the other (Xs) constant.
- Coefficient of Multiple Determination (R^2): Refers to the proportion of the total variation in Y "explained" by the multiple regression of Y on X_1, X_2, \dots . This means that the adequacy of a linear model can be assessed by an inspection of the magnitude of (R^2). The maximum value possible of (R^2) is one. Thus, the closer a (R^2) value is to one, the more adequate is the linear model used.
- Example: A three-variable linear regression model can be written as:

$$Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + b_3X_{3i}$$

Note: b_0 refers to the intercept term and can be used to gauge the slope of a regression line, if it was plotted.

B. BOOTSTRAPPING'S USE OF THE LINEAR MODEL

The excerpt that follows provides a good overview of how Bootstrap methodology utilizes the linear regression model.

[Ref. 11:pp. 119-120]

THE LINEAR MODEL

The linear model is one in which judgments are described as a simple weighted sum of the values of the information available. For a given clinician judging a number of people, we let J represent the judgment and consider it as a dependent variable. The dimensions of information are designated by X 's. These will, of course, be independent variables. If there are k sources of information, the linear additive model can be described as follows:

$$J = f(X_i) \\ i = 1, 2, \dots, k$$

Since we are interested in a weighted sum of the X , we may write

$$J = A_0 + A_1X_1 + A_2X_2 + \dots + A_kX_k.$$

If the A 's are so chosen as to yield the best possible weighted sum, i.e., so that the composite scores correlate maximally with J , the model is equivalent to a linear multiple regression equation wherein the weights to be applied to the independent variables are so chosen as to minimize the error in estimating an actual dependent variable from the weighted composite.

Application of multiple regression procedures to the problems of judgment has been suggested by Brunswick (1947), and by Hammond (1955). Todd (1954) reports a study using regression coefficients and the multiple correlation coefficient for a description of the clinical judgment process, where the task was to judge intelligence from a selected number of Rorschach signs. While such studies provide interesting implications, it should be stressed that there are serious limitations with respect to the interpretation of results; limitations which may be minimized or overcome only through a detailed examination of the rationale underlying the model, and through reformulations or revisions of the model, should this be necessary. So as to insure the appropriateness of the linear model as a device for characterizing the judgment process, we consider in detail some of its properties, and provide the particular reformulations where necessary.

In the first place, and by virtue of the experimental control employed in the collection of the data, the only source of reliable judgment variance is from the information supplied. This is in objective form, e.g., it appears as a number, a designated category, "a position along a continuum" etc. Often these data appear as test scores on a set of protocols being judged. Assuming that a judge combined the information in linear additive fashion, the multiple regression analysis will be quite effective as a tool for describing the judgment process; i.e., the set of regression weights when applied to the corresponding predictors can quite properly serve as a model for judgment. Thus, the adequacy of the linear model can be assessed by inspection of the magnitude of multiple R . If the judge integrates data in additive fashion as opposed to configurational or pattern analysis, the linear multiple correlation will approach unity when corrected for attenuation. Lesser values of R suggest progressively lesser utility for the linear model.

Secondly, it may be noted that the regression weights signify, with certain limitations, the emphasis or importance attached to each of the predictor variables by the judge. Large coefficients mean, empirically, that the corresponding predictors can account for large proportions of the variance of judgment; and a predictor with a small beta coefficient contributes little beyond the contribution of other predictors. In practice, characterization of the judgment process by means of beta coefficients has three limitations: (a) since J 's differ with respect to the size of their multiple R , direct comparisons of sets of beta coefficients between J 's is not meaningful; (b) beta coefficients do not account for all the predictable variance; and (c) beta coefficients do not allow for the assessment of the *independent* contribution of each predictor. What would be more appropriate would be a set of weights which are comparable from one J to the next, which are capable theoretically of accounting for all of the predictable variance, and which carry exact interpretation in terms of components of variance.

C. BOOTSTRAPPING VIA SAS

To obtain the statistical data necessary to derive the values in Tables 7.2 to 7.7, 54 SAS programs were compiled and processed. That is, a SAS analysis was conducted for each combat readiness profile (six profiles) for each group (nine groups). What follows is a narration of only one SAS analysis for one group. The exact process was duplicated for each group/profile by changing the X and J variables accordingly.

J is used in lieu of Y to denote the responses of those surveyed. That is, each survey participant was assigned a J value, i.e., J1, J2, etc. A X was used to denote a readiness factor. That is, X1 = % manning level, X2 = % critical MOS, etc.

The SAS program example that follows was for the "ground field grade" sample group, in respect to the survey's "personnel" model profile:

```
DATA DIM1
INPUT OBS X1 X2 X3 X4 J1 . . . J10;
CARDS;
(Data Set);
DATA MAJOR1;
    ARRAY X X1-X4;
    ARRAY J J1-J10;
```



```

        SET DIM1;

        J11 = 0;

        DO OVER J;

        J11 = J11 + J/10;

        IF OBS ≠ 21;

        END;

PROC REG DATA = MAJOR1;

        MODEL J1 - J11 = X1 - X4;

        OUTPUT OUT = PERSDATA;

PROC PRINT DATA = PERSDATA;

```

Each line of the example SAS program above refers to a procedure to be executed. For those interested in a detailed description of each of the above procedures, see Reference 17.

Of particular note in the above program is the "J11" value. Subject group was composed of only ten survey respondents. Yet, by assigning "J11" to equal 0 and subsequently denoting that "J11 = J11 + J/10", an aggregate group average value assessment was obtained. Appropriate aggregate group averages were computed for each group.

Also of interest is the "ARRAY"... procedure. The "ARRAY PROC" allows one to process many variables the same way. That is, in regards to this study, the "ARRAY PROC" was used to consolidate multiple survey responses (Js)

against the same "profile" (Xs). For example, all ten GNDFGs, four GNDCOLSSs, ten GNDCGs, etc., were processed against the appropriate profile at the same time.

D. AGGREGATE GROUP STATISTICS

Selected statistics from the SAS output, for each of the 54 programs, were extracted and compiled onto a Lotus 1,2,3 spreadsheet [Ref. 18]. The data sets that follow depict the aggregate group values selected for analysis.

In regards to the data displayed, only the following values were used for analysis in this study:

R Squared

X_N Beta Coefficients

WT (Normalized Weights)

The other items displayed could be used for further statistical analysis, i.e., significance testing. Yet, again due to the constraints of time and conducting single person research, further statistical analysis was not conducted.

OVERALL READINESS PROFILE DATA:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.7500	42.5600	11.4000	8.4800	0.0007
GFG (10)	0.9000	44.5000	11.7300	24.4400	0.0001
GCG (10)	0.9600	50.3100	10.0300	73.0200	0.0001
ACOL (2)	0.9400	46.1300	11.5400	45.4000	0.0001
AFG (5)	0.8900	46.8400	13.8100	23.7700	0.0001
ACG (5)	0.8100	54.3000	8.9800	11.8500	0.0001
CSSCOL (1)	0.7500	35.2100	9.3500	8.4500	0.0007
CSSFG (4)	0.7000	45.8400	7.9900	6.4500	0.0026
CSSCG (5)	0.8100	49.0000	9.5200	11.8800	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	-9.9200	9.4300	-1.0500	0.3106
GFG (10)	-4.8900	4.6400	-1.0500	0.0017
GCG (10)	-6.4100	3.2000	-2.0100	0.0647
ACOL (2)	-20.2700	4.6200	-4.3900	0.0006
AFG (5)	-28.8000	7.4400	-3.8700	0.0017
ACG (5)	8.6400	6.6200	1.3300	0.2063
CSSCOL (1)	-7.9100	7.7400	-1.0200	0.3243
CSSFG (4)	5.2300	7.3000	0.7200	0.4846
CSSCG (5)	-1.8100	6.9000	-0.2600	0.7969

PERSONNEL (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	4.6100	0.8400	5.5000	0.0001	0.4450
GFG (10)	2.1200	0.4100	5.1300	0.0002	0.2150
GCG (10)	1.9300	0.2800	6.7800	0.0001	0.1700
ACOL (2)	3.7800	0.4100	9.2000	0.0001	0.2861
AFG (5)	3.3600	0.6600	5.0700	0.0002	0.2224
ACG (5)	2.0200	0.5800	3.4900	0.0036	0.2215
CSSCOL (1)	3.7800	0.6900	5.4900	0.0001	0.4431
CSSFG (4)	1.9900	0.6500	3.0600	0.0084	0.2460
CSSCG (5)	3.1200	0.6100	5.0900	0.0002	0.3089

EQUIPMENT AND SUPPLIES QUANTITY (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	2.0000	0.8200	2.4300	0.0292	0.1931
GFG (10)	1.5600	0.4100	3.8400	0.0018	0.1582
GCG (10)	1.7000	0.22800	6.0800	0.0001	0.1498
ACOL (2)	2.0500	0.4000	5.0800	0.0002	0.1552
AFG (5)	1.8400	0.6500	2.8200	0.0135	0.1218
ACG (5)	1.4800	0.5700	2.5900	0.0213	0.1623
CSSCOL (1)	1.6300	0.6800	2.4000	0.0307	0.1911
CSSFG (4)	1.4000	0.6400	2.2000	0.0452	0.1731
CSSCG (5)	2.1400	0.6000	3.5500	0.0032	0.2119

EQUIPMENT CONDITION (X3) DATA:

OBS	X3B	SE	T	P	WT
GCOL (4)	1.3000	0.8500	1.5300	0.1496	0.1255
GFG (10)	1.5400	0.4200	3.6700	0.0025	0.1562
GCG (10)	1.7600	0.2900	6.1100	0.0001	0.1551
ACOL (2)	1.9700	0.4200	4.7400	0.0003	0.1491
AFG (5)	2.1100	0.6700	3.1400	0.0072	0.1396
ACG (5)	1.7200	0.5900	2.9200	0.0111	0.1886
CSSCOL (1)	1.0700	0.7000	1.5300	0.1489	0.1254
CSSFG (4)	1.4900	0.6600	2.2700	0.0397	0.1842
CSSCG (5)	2.0000	0.6200	3.2100	0.0063	0.1980

TRAINING (X4) DATA:

OBS	X4B	SE	T	P	WT
GCOL (4)	1.0000	0.8100	1.2400	0.2353	0.0965
GFG (10)	2.0200	0.4000	5.0400	0.0002	0.2049
GCG (10)	3.4600	0.2800	12.5700	0.0001	0.3048
ACOL (2)	2.0600	0.4000	5.1900	0.0001	0.1559
AFG (5)	4.1200	0.6400	6.4300	0.0001	0.2727
ACG (5)	2.9300	0.5600	5.2200	0.0001	0.3213
CSSCOL (1)	0.8400	0.6700	1.2600	0.2273	0.0985
CSSFG (4)	1.5400	0.6200	2.4600	0.0278	0.1904
CSSCG (5)	1.4900	0.5900	2.5000	0.0254	0.1475

COMMAND, CONTROL, COMMUNICATIONS (C3) AND CLIMATE (X5) DATA:

OBS	X5B	SE	T	P	WT
GCOL (4)	1.4500	0.8200	1.7700	0.0990	0.1400
GFG (10)	2.6200	0.4100	6.4600	0.0001	0.2657
GCG (10)	2.5000	0.2800	8.9200	0.0001	0.2203
ACOL (2)	3.3500	0.4000	8.3100	0.0001	0.2536
AFG (5)	3.6800	0.6500	5.6700	0.0001	0.2435
ACG (5)	0.9700	0.5700	1.7000	0.1118	0.1064
CSSCOL (1)	1.2100	0.6800	1.7900	0.0944	0.1419
CSSFG (4)	1.6700	0.6400	2.6100	0.0205	0.2064
CSSCG (5)	1.3500	0.6000	2.2300	0.0425	0.1337

PERSONNEL PROFILE DATA:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.9200	51.7500	13.8100	43.5200	0.0001
GFG (10)	0.9200	48.6500	13.5000	43.9000	0.0001
GCG (10)	0.9200	51.9500	11.5700	45.2200	0.0001
ACOL (2)	0.8400	49.6300	12.9000	19.7000	0.0001
AFG (5)	0.9400	49.6500	13.9600	54.0900	0.0001
ACG (5)	0.9500	51.7000	12.8300	70.4300	0.0001
CSSCOL (1)	0.6600	51.1900	12.7100	7.1200	0.0020
CSSF (4)	0.9200	51.0000	10.6500	45.7500	0.0001
CSSCG (5)	0.9000	48.7000	14.3300	35.0700	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	-12.4000	5.6100	-2.2100	0.0431
GFG (10)	-16.8000	5.4800	-3.0800	0.0076
GCG (10)	-7.4400	4.6200	-1.6100	0.1282
ACOL (2)	-8.5100	7.4400	-1.1400	0.2707
AFG (5)	-21.5600	5.1200	-4.2100	0.0008
ACG (5)	-14.2300	4.1600	-3.4200	0.0038
CSSCOL (1)	-2.3800	10.7800	-0.2200	0.8278
CSSF (4)	-10.5835	10.7415	-12.2593	0.3704
CSSCG (5)	-18.4363	11.0925	-2.0416	0.2011

PERCENT MANNING LEVEL (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	5.7900	0.5500	10.4400	0.0001	0.4570
GFG (10)	5.7300	0.5400	10.5900	0.0001	0.4425
GCG (10)	3.6800	0.4600	8.0500	0.0001	0.3116
ACOL (2)	5.4700	0.7400	72.4400	0.0001	0.4769
AFG (5)	4.6300	0.5100	9.5100	0.0001	0.3274
ACG (5)	4.6300	0.4100	11.2400	0.0001	0.3545
CSSCOL (1)	2.6400	1.0600	2.4700	0.0259	0.2596
CSSFG (4)	4.4700	0.4200	10.7000	0.0001	0.4352
CSSCG (5)	5.8400	0.6300	9.6300	0.0001	0.4272

PERCENT CRITICAL MOS (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	2.0800	0.5400	3.8300	0.0016	0.1642
GFG (10)	2.3600	0.5300	4.4400	0.0005	0.1822
GCG (10)	2.0900	0.4500	4.6600	0.0003	0.1770
ACOL (2)	2.6700	0.7200	3.6900	0.0022	0.2328
AFG (5)	2.1800	0.5000	4.3900	0.0005	0.1542
ACG (5)	3.6500	0.4000	9.0500	0.0001	0.2795
CSSCOL (1)	4.6300	1.0400	4.4300	0.0005	0.4553
CSSFG (4)	2.6300	0.4100	6.4200	0.0001	0.2561
CSSCG (5)	3.0500	0.6200	4.9000	0.0002	0.2231

PERCENT E-5s AND ABOVE (X3) DATA:

OBS	X3B	SE	T	P	WT
GCOL (4)	1.4100	0.5600	2.5100	0.0239	0.1113
GFG (10)	2.2900	0.5500	4.1700	0.0008	0.1768
GCG (10)	2.9600	0.4600	6.3900	0.0001	0.2506
ACOL (2)	1.9900	0.7500	2.6700	0.0175	0.1735
AFG (5)	4.0900	0.5100	7.9700	0.0001	0.2893
ACG (5)	1.8200	0.4200	4.3700	0.0005	0.1394
CSSCOL (1)	1.6300	1.0800	1.5100	0.1531	0.1603
CSSFG (4)	1.6700	0.4200	3.9300	0.0013	0.1626
CSSCG (5)	2.8100	0.6400	4.3500	0.0006	0.2056

SERVICE EXPERIENCE (X4) DATA:

OBS	X4B	SE	T	P	WT
GCOL (4)	3.3900	0.5400	6.3100	0.0001	0.2676
GFG (10)	2.5700	0.5200	4.9000	0.0002	0.1985
GCG (10)	3.0800	0.4400	6.6700	0.0001	0.2608
ACOL (2)	1.3400	0.7100	1.8800	0.0796	0.1168
AFG (5)	3.2400	0.4900	6.6100	0.0001	0.2291
ACG (5)	2.9600	0.4000	7.4300	0.0001	0.2266
CSSCOL (1)	1.2700	1.0300	1.2300	0.2363	0.1249
CSSFG (4)	1.5000	0.4000	3.7000	0.0021	0.1461
CSSCG (5)	1.9700	0.6100	3.2000	0.0059	0.1441

EQUIPMENT AND SUPPLIES (QUANTITY) PROFILE DATA:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.8400	45.5000	17.3500	43.5300	0.0001
GFG (10)	0.8900	45.4800	14.1300	71.6900	0.0001
GCG (10)	0.9200	49.2500	13.9000	97.2500	0.0001
ACOL (2)	0.8400	47.6300	14.0500	126.2700	0.0001
AFG (5)	0.8600	48.2000	17.0200	54.3000	0.0001
ACG (5)	0.8900	50.9000	14.8400	66.6000	0.0001
CSSCOL (1)	0.6900	48.0000	17.5000	18.7200	0.0001
CSSFG (4)	0.9100	47.9400	12.8900	87.1400	0.0001
CSSCG (5)	0.8700	46.4500	14.9200	58.2600	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	-17.0600	7.0200	-2.4300	0.0264
GFG (10)	-7.2500	4.6000	-1.5800	0.1337
GCG (10)	-3.9600	3.9400	-1.0000	0.3291
ACOL (2)	-6.8700	3.5300	-1.9500	0.0684
AFG (5)	-13.4700	6.2700	-2.1500	0.0462
ACG (5)	-4.9100	4.9900	-0.9600	0.3492
CSSCOL (1)	-4.2400	11.2300	-0.3800	0.7088
CSSFG (4)	-0.7200	3.8400	-0.1900	0.8538
CSSCG (5)	-8.2500	5.3200	-1.5500	0.1401

PERCENT EQUIPMENT (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	7.3800	0.9300	7.8700	0.0001	0.6029
GFG (10)	6.1900	0.6200	10.0500	0.0001	0.5998
GCG (10)	5.8000	0.5300	11.0000	0.0001	0.5566
ACOL (2)	5.6800	0.4700	12.0300	0.0001	0.5318
AFG (5)	7.6100	0.8400	9.0800	0.0001	0.6310
ACG (5)	6.1300	0.6700	9.1900	0.0001	0.5619
CSSCOL (1)	8.5300	1.5000	5.6800	0.0001	0.7021
CSSFG (4)	6.6500	0.5100	10.9900	0.0001	0.6327
CSSCG (5)	6.5800	0.7100	9.2400	0.0001	0.6150

PERCENT SUPPLIES (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	4.8600	0.9200	5.2700	0.0001	0.3971
GFG (10)	4.1300	0.6000	6.8400	0.0001	0.4002
GCG (10)	4.6200	0.5200	8.9400	0.0001	0.4434
ACOL (2)	5.0000	0.4600	10.7800	0.0001	0.4682
AFG (5)	4.4500	0.8200	5.4200	0.0001	0.3690
ACG (5)	4.7800	0.6600	7.9200	0.0001	0.4381
CSSCOL (1)	3.6200	1.4700	2.5000	0.0250	0.2979
CSSFG (4)	3.8600	0.5000	7.6800	0.0001	0.3673
CSSCG (5)	4.1200	0.7000	5.8900	0.0001	0.3850

EQUIPMENT CONDITION PROFILE DATA:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.8500	46.2500	13.8000	32.3700	0.0001
GFG (10)	0.9000	45.8300	11.8400	49.2000	0.0001
GCG (10)	0.9400	48.7800	11.5200	77.4300	0.0001
ACOL (2)	0.9300	47.2500	11.7200	73.5400	0.0001
AFG (5)	0.9200	50.0000	15.5900	64.9000	0.0001
ACG (5)	0.8300	54.6000	10.2300	26.8800	0.0001
CSSCOL (1)	0.8100	49.0000	14.5000	22.3000	0.0001
CSSFG (4)	0.9000	50.6000	11.7200	47.7500	0.0001
CSSCG (5)	0.8600	46.2500	9.8600	33.9500	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	-6.0700	6.5300	-0.9300	0.3669
GFG (10)	-0.9200	4.6600	-0.2000	0.8457
GCG (10)	-2.5300	3.6800	-0.6900	0.5023
ACOL (2)	0.3300	3.8300	0.0900	0.9330
AFG (5)	-17.5300	5.4100	-3.2400	0.0051
ACG (5)	11.7600	5.2400	22.2500	0.0392
CSSCOL (1)	8.5000	10.5900	0.8000	0.4341
CSSFG (4)	2.3700	4.6700	0.5100	0.6189
CSSCG (5)	5.6100	4.5700	1.2300	0.2381

PERCENT EQUIPMENT COMBAT READY (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	6.2200	0.7100	8.6800	0.0001	0.6062
GFG (10)	5.0400	0.5100	9.8900	0.0001	0.5502
GCG (10)	4.9800	0.4000	12.3500	0.0001	0.4936
ACOL (2)	5.3200	0.4200	12.6600	0.0001	0.5789
AFG (5)	6.8900	0.5900	11.6300	0.0001	0.5192
ACG (5)	3.6200	0.5700	6.3200	0.0001	0.4294
CSSCOL (1)	9.3200	1.1600	8.0300	0.0001	0.7741
CSSFG (4)	5.0700	0.5100	9.9000	0.0001	0.5422
CSSCG (5)	4.0500	0.5000	8.1000	0.0001	0.5075

PERCENT END ITEMS COMBAT READY (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	3.4500	0.7100	4.9000	0.0002	0.3363
GFG (10)	3.6900	0.5000	7.3600	0.0001	0.4028
GCG (10)	3.3100	0.4000	8.3700	0.0001	0.3280
ACOL (2)	3.3600	0.4100	8.1400	0.0001	0.3656
AFG (5)	4.3200	0.5800	7.4300	0.0001	0.3255
ACG (5)	3.5500	0.5600	6.3000	0.0001	0.4211
CSSCOL (1)	1.7200	1.1400	0.1510	0.1504	0.1429
CSSFG (4)	3.4900	0.5000	6.9400	0.0001	0.3733
CSSCG (5)	2.9900	0.4900	6.0800	0.0001	0.3747

MODERNIZATION (X3) DATA:

OBS	X3B	SE	T	P	WT
GCOL (4)	0.5900	0.7300	0.8100	0.4307	0.0575
GFG (10)	0.4300	0.5200	0.8200	0.4223	0.0469
GCG (10)	1.8000	0.4100	4.4100	0.0004	0.1784
ACOL (2)	0.5100	0.4300	1.2100	0.2446	0.0555
AFG (5)	2.0600	0.6000	3.4400	0.0034	0.1552
ACG (5)	1.2600	0.5800	2.1600	0.0463	0.1495
CSSCOL (1)	-1.0000	1.1700	-0.8500	0.4068	-0.0831
CSSFG (4)	0.7900	0.5200	1.5300	0.1460	0.0845
CSSCG (5)	0.9400	0.5100	1.8600	0.0817	0.1178

TRAINING PROFILE DATA:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.8900	52.0000	11.3800	30.9000	0.0001
GFG (10)	0.9500	46.9000	11.5600	69.0400	0.0001
GCG (10)	0.9600	50.7200	11.0000	99.8000	0.0001
ACOL (2)	0.9400	50.7000	8.3400	58.4900	0.0001
AFG (5)	0.9400	50.7000	13.5000	59.1600	0.0001
ACG (5)	0.8800	53.9500	10.1700	28.8300	0.0001
CSSCOL (1)	0.7100	53.7500	12.0400	9.1000	0.0006
CSSFG (4)	0.8600	49.5900	7.6400	23.4000	0.0001
CSSCG (5)	0.9600	48.4000	11.5100	85.5000	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	0.2800	5.3900	0.0500	0.9591
GFG (10)	-6.0600	3.7800	-1.6200	0.1301
GCG (10)	-3.8100	3.0200	-1.2600	0.2258
ACOL (2)	7.5500	2.9500	2.5600	0.0219
AFG (5)	-16.5200	2.7500	-3.4800	0.0034
ACG (5)	6.5300	2.9700	1.3100	0.2089
CSSCOL (1)	20.8500	13.6200	1.5300	0.1467
CSSFG (4)	14.6300	4.1000	3.5700	0.0028
CSSCG (5)	-8.9800	3.4000	-2.6400	0.0186

INDIVIDUAL SKILLS TRAINING (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	4.5100	0.5300	8.4500	0.0001	0.4417
GFG (10)	4.9900	0.3700	13.3300	0.0001	0.4789
GCG (10)	4.7700	0.3000	15.9800	0.0001	0.4429
ACOL (2)	3.1100	0.2900	10.6500	0.0001	0.3685
AFG (5)	5.2700	0.4700	11.2200	0.0001	0.3974
ACG (5)	3.8200	0.4900	7.7700	0.0001	0.4086
CSSCOL (1)	7.1100	1.3400	5.2800	0.0001	0.5390
CSSFG (4)	2.9600	0.4000	7.3200	0.0001	0.4302
CSSCG (5)	4.3300	0.3400	12.8800	0.0001	0.3822

PERCENT UNIT TRAINING COMPLETED (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	3.6100	0.5200	6.8900	0.0001	0.3536
GFG (10)	3.5400	0.3700	9.6500	0.0001	0.3397
GCG (10)	2.7100	0.3000	9.2600	0.0001	0.2516
ACOL (2)	2.3400	0.2800	8.0400	0.0001	0.2773
AFG (5)	4.1600	0.4600	9.0300	0.0001	0.3137
ACG (5)	3.3500	0.4800	6.9400	0.0001	0.3583
CSSCOL (1)	3.3200	1.3200	2.5100	0.0237	0.2517
CSSFG (4)	2.3400	0.4000	5.9000	0.0001	0.3401
CSSCG (5)	3.9300	0.3300	11.9100	0.0001	0.3469

JOINT MAGTF ELEMENT TRAINING (X3) DATA:

OBS	X3B	SE	T	P	WT
GCOL (4)	0.9300	0.5400	1.7200	0.1064	0.0911
GFG (10)	1.1300	0.3800	2.9900	0.0092	0.1084
GCG (10)	1.7900	0.3000	5.9200	0.0001	0.1662
ACOL (2)	1.2200	0.3000	4.1500	0.0009	0.1445
AFG (5)	2.3600	0.4800	4.9700	0.0002	0.1780
ACG (5)	1.1800	0.4900	2.3800	0.0311	0.1262
CSSCOL (1)	-2.1400	1.3400	-1.5600	0.1388	-0.1622
CSSFG (4)	0.9800	0.4100	2.3900	0.0302	0.1424
CSSCG (5)	1.5000	0.3400	4.3800	0.0005	0.1324

MAGTF AND NAVY TRAINING (X4) DATA:

OBS	X4B	SE	T	P	WT
GCOL (4)	1.1600	0.5200	2.2400	0.0407	0.1136
GFG (10)	0.7600	0.3600	2.1100	0.0523	0.0729
GCG (10)	1.5000	0.2900	5.1900	0.0001	0.1393
ACOL (2)	1.7700	0.2900	6.2900	0.0001	0.2097
AFG (5)	1.4700	0.4600	3.2500	0.0054	0.1109
ACG (5)	1.0000	0.4800	2.0900	0.0536	0.1070
CSSCOL (1)	-0.6200	1.3000	-0.4800	0.6385	-0.0470
CSSFG (4)	0.6000	0.3900	1.5400	0.1444	0.0872
CSSCG (5)	1.5700	0.3300	4.8400	0.0002	0.1386

COMMAND, CONTROL, COMMUNICATIONS (C3) AND CLIMATE:

GENERAL DATA:

OBS	R SQR	DEP MEAN	STD	F VALUE	P>F
GCOL (4)	0.9000	47.1300	11.6300	25.7000	0.0001
GFG (10)	0.9300	44.2000	10.9100	35.4300	0.0001
GCG (10)	0.9600	50.2300	10.9700	76.9300	0.0001
ACOL (2)	0.8100	47.2300	11.8600	11.8600	0.0001
AFG (5)	0.9300	47.1000	15.2000	28.3200	0.0001
ACG (5)	0.8900	54.1000	9.7900	23.0000	0.0001
CSSCOL (1)	0.9100	50.2100	10.8300	27.4600	0.0001
CSSFG (4)	0.8300	47.9600	8.9300	13.4100	0.0001
CSSCG (5)	0.9700	49.1000	10.0000	79.3500	0.0001

INTERCEPT DATA:

OBS	INTCPTB	SE	T	P
GCOL (4)	-17.1100	6.0500	-2.8300	0.0134
GFG (10)	-15.3100	4.900	-3.1200	0.0075
GCG (10)	-9.7300	3.4100	-2.8500	0.0128
ACOL (2)	-12.6400	8.6000	-1.4700	0.1635
AFG (5)	-34.9500	6.5800	-5.3000	0.0001
ACG (5)	0.5700	5.3500	0.1100	0.9170
CSSCOL (1)	-11.1900	5.4700	-2.0500	0.0599
CSSFG (4)	2.6800	6.1600	0.4400	0.6700
CSSCG (5)	-10.0000	3.0700	-3.2600	0.0057

UNIT MORALE (X1) DATA:

OBS	X1B	SE	T	P	WT
GCOL (4)	4.3400	0.5400	8.0500	0.0001	0.3401
GFG (10)	2.4500	0.4400	5.6200	0.0001	0.2064
GCG (10)	2.6800	0.3000	8.8400	0.0001	0.2248
ACOL (2)	1.7300	0.7700	2.2600	0.0406	0.1445
AFG (5)	4.0900	0.5900	6.9700	0.0001	0.2502
ACG (5)	2.8800	0.4700	6.0600	0.0001	0.2704
CSSCOL (1)	3.7200	0.4900	7.6600	0.0001	0.3049
CSSFG (4)	2.1700	0.5500	3.9600	0.0014	0.2406
CSSCG (5)	2.1800	0.2700	7.9900	0.0001	0.1851

UNIT LEADERSHIP (X2) DATA:

OBS	X2B	SE	T	P	WT
GCOL (4)	2.0600	0.5300	3.9000	0.0016	0.1614
GFG (10)	2.4300	0.4200	5.6800	0.0001	0.2047
GCG (10)	3.9200	0.3000	13.1500	0.0001	0.3289
ACOL (2)	2.7000	0.7500	3.5900	0.0029	0.2256
AFG (5)	2.9000	0.5800	5.0400	0.0002	0.1774
ACG (5)	1.6900	0.4700	3.6200	0.0028	0.1587
CSSCOL (1)	2.0700	0.4800	4.3200	0.0007	0.1697
CSSFG (4)	1.7500	0.5400	3.2700	0.0056	0.1940
CSSCG (5)	3.1800	0.2700	11.8700	0.0001	0.2699

COMMAND, CONTROL AND COMMUNICATIONS (X3) DATA:

OBS	X3B	SE	T	P	WT
GCOL (4)	2.8500	0.5500	5.2200	0.0001	0.2234
GFG (10)	1.6200	0.4400	3.6600	0.0026	0.1365
GCG (10)	1.6900	0.3100	5.4800	0.0001	0.1418
ACOL (2)	4.3400	0.7800	5.6000	0.0001	0.3626
AFG (5)	1.4200	0.5900	2.3900	0.0314	0.0869
ACG (5)	1.5100	0.4800	3.1400	0.0073	0.1418
CSSCOL (1)	2.6500	0.4900	5.3800	0.0001	0.2172
CSSFG (4)	1.7100	0.5600	3.0800	0.0081	0.1896
CSSCG (5)	2.1600	0.2700	7.8300	0.0001	0.1834

INTELLIGENCE (X4) DATA:

OBS	X4B	SE	T	P	WT
GCOL (4)	1.3400	0.5200	2.5800	0.0220	0.1050
GFG (10)	1.2600	0.4200	2.9800	0.0100	0.1061
GCG (10)	0.5700	0.2900	1.9500	0.0711	0.0478
ACOL (2)	0.7600	0.7400	1.0300	0.3210	0.0635
AFG (5)	2.2900	0.5700	4.0500	0.0012	0.1401
ACG (5)	2.9600	0.4600	6.4400	0.0001	0.2779
CSSCOL (1)	1.3900	0.4700	2.6500	0.0106	0.1139
CSSFG (4)	0.3100	0.5300	0.5800	0.5690	0.0344
CSSCG (5)	1.6600	0.2600	6.2800	0.0001	0.1409

COMMANDING OFFICER'S JUDGEMENT (X5) DATA:

OBS	X5B	SE	T	P	WT
GCOL (4)	2.1700	0.5300	4.1100	0.0011	0.1701
GFG (10)	4.1100	0.4300	9.6100	0.0001	0.3463
GCG (10)	3.0600	0.3000	10.2500	0.0001	0.2567
ACOL (2)	2.4400	0.7500	3.2400	0.0059	0.2038
AFG (5)	5.6500	0.5800	9.800	0.0001	0.3456
ACG (5)	1.6100	0.4700	3.4500	0.0039	0.1512
CSSCOL (1)	2.3700	0.4600	4.9700	0.0002	0.1943
CSSFG (4)	2.0800	0.5400	5.7200	0.0001	0.3415
CSSCG (5)	2.6000	0.2700	9.7100	0.0001	0.2207

E. COMPUTATION OF THE NORMALIZED WEIGHT VALUE

Since the above groups differ with respect to the size of their R^2 value, direct comparison of sets of beta (B) coefficients between groups would not be meaningful. Accordingly, a normalized weight value was computed for each group (via Lotus 1,2,3) in order to compare one group to the next.

What follows is an example of the formula used to compute the "percent manning level" normalized weight value. I will use the "colonel ground" sample group, with respect to the survey's "personnel" model beta coefficient assessment values. A like formula was used for each factor, within each group.

$$X1 = \% \text{ ML}$$

$$X2 = \% \text{ CMOS}$$

$$X3 = \% > E-5$$

$$X4 = \text{SEXP}$$

$$\text{ABS} = \text{Absolute Value}$$

$$\text{WT} = X1 / (\text{ABS}X1 + \text{ABS}X2 + \text{ABS}X3 + \text{ABS}X4)$$

$$\text{WT} = 5.79 / (5.79 + 2.08 + 1.41 + 3.39)$$

$$\text{WT} = .475$$

APPENDIX G

GENERAL INFORMATION IN REGARDS TO EXPERT77

This appendix contains general informational documents that pertain to the EXPERT77 software package referred to in the text of this study.

EXPERT77

DECISION SOFTWARE FOR MANAGERS AND SCIENTISTS

On January 1, 1986, MAGIC77 Software will release its current version of EXPERT77 to a limited group of customers.

EXPERT77 is the first quasi-AI software tool capable of single-session solutions for a broad spectrum of decision/judgement/evaluation problems in a microcomputer environment.

EXPERT77 is a tool for guiding you towards a better understanding of either personal or organizational problems; problems which typically require policy decisions. Many areas of application, including investment policy, purchasing decisions, personnel evaluation, compensation systems, evaluation of department/division performance, and many others.

EXPERT77 acquires the reliable component of a user's intuitive knowledge and applies this knowledge objectively and accurately (in EXPERT SYSTEM mode) to your data base or to any individual problem.

For IBM PC / 128K and clones. Version 4.0 permits creation of your own hierarchically structured data base.

May be customized for your existing D-base II, D-base III or DOS data files.

Price \$495

ORGANIZATIONS EXIST FOR A PURPOSE.

OBJECTIVES ARE STATEMENTS OF PURPOSE AND DIRECTION, FORMALIZED INTO A SYSTEM OF MANAGEMENT.

THE SYSTEM OF MANAGEMENT RESIDES IN THE ORGANIZATIONAL MEMBERS' PERCEPTIONS OF PURPOSE.

A MEMBER'S BEHAVIOR IS GUIDED BY AN INTERNALIZED PERCEPTION OF WHAT IS APPROPRIATE.

CONTINUITY OF EFFORT COMES FROM A SHARED UNDERSTANDING OF PURPOSE.

THIS SHARED UNDERSTANDING PROVIDES THE ORGANIZATIONAL MEMBERS WITH A FIRMER BASE FOR DEVELOPING AND INTEGRATING PLANS AND PERSONAL AND DEPARTMENTAL ACTIVITY.

WHAT IS ORGANIZATIONAL EFFECTIVENESS?

HOW WELL THE ORGANIZATION (SYSTEM) MEETS ITS GOALS.

IT IS AN ABSTRACTION WHICH CAN ONLY BE UNDERSTOOD BY AGGREGATING THE VALUES AND PREFERENCES OF ORGANIZATION MEMBERS.

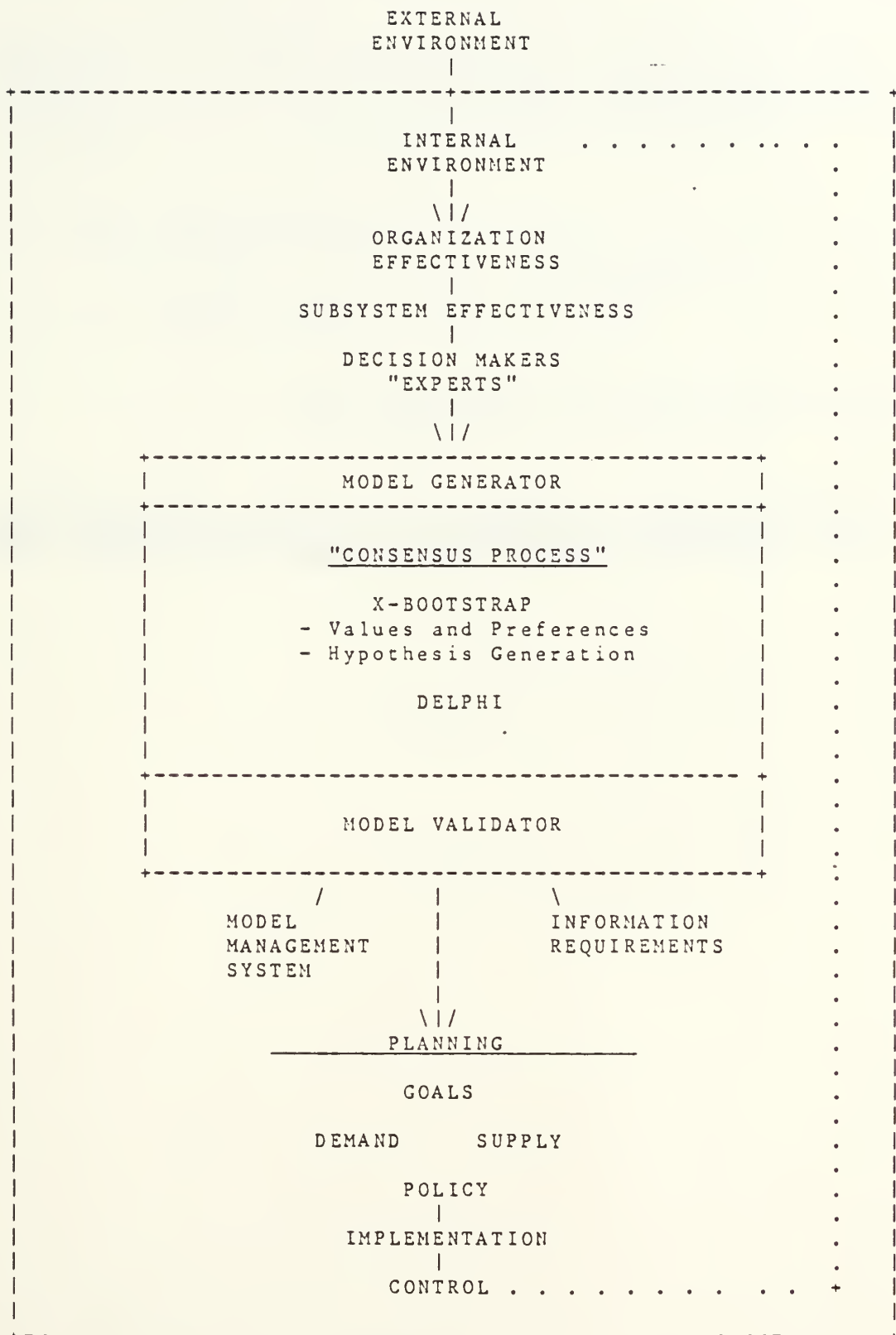
WHY IS AN UNDERSTANDING OF ORGANIZATIONAL EFFECTIVENESS IMPORTANT?

WITHOUT A MEANINGFUL STATEMENT OF EFFECTIVENESS, CONTINUITY OF EFFORT IS A CHANCE OCCURRENCE.

THE HALLMARKS OF ORGANIZATIONS SUGGEST THAT AN ORGANIZATION'S RELATIONS WITH THE ENVIRONMENT ARE VERY COMPLEX AND MULTIDIMENSIONAL.

THIS COMPLEXITY LEADS TO A KIND OF AMBIGUITY OF PURPOSE WHICH PERVADES ORGANIZATIONAL LIFE TODAY.

SYSTEMIC UNDERSTANDING OF ORGANIZATIONAL EFFECTIVENESS



UNITED WE STAND AND DIVIDED WE FALL: THE USE OF BOOTSTRAP IN
THE EXPLICATION OF ORGANIZATIONAL EFFECTIVENESS

X-BOOTSTRAP

DEFINITION - A METHOD FOR EXPLICATING A HIERARCHICAL MODEL OF ORGANIZATIONAL (SYSTEM) EFFECTIVENESS FROM ORGANIZATIONAL "EXPERTS".

THE BASIC LOGIC IS AS FOLLOWS:

- (1) TOTAL SYSTEM EFFECTIVENESS
IS A FUNCTION OF SUBSYSTEM EFFECTIVENESS.
- (2) SUBSYSTEM EFFECTIVENESS
IS A FUNCTION OF SUBSYSTEM OUTPUT.
- (3) SUBSYSTEM OUTPUT
IS A FUNCTION OF SUBSYSTEM ELEMENTS AND
ATTRIBUTES.

X-BOOTSTRAP ALSO EXPOSES A WIDE VARIETY OF ISSUES, QUESTIONS AND PROBLEMS THAT MUST BE CONSIDERED IF WE WISH TO DESIGN ORGANIZATIONS THAT UNDERSTAND THEIR PURPOSE.

ENGINEERING EFFECTIVENESS IS A FUNCTION OF:

PLANNING AND ADMINISTRATION PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

INFORMATION GATHERING PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

SYNTHESIS PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

ANALYSIS PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

REPORTING RESULTS PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

EDUCATION PROCESS

- MANAGEMENT INFORMATION
- DESIGN/ANALYSIS INFORMATION
- SIMULATION/ANALYSIS INFORMATION
- TEST/ANALYSIS INFORMATION

MANAGEMENT INFORMATION IS A FUNCTION OF:

- PEOPLE
- FACILITIES
- EQUIPMENT
- MATERIAL
- TRAINING

PRODUCTIVITY IS A FUNTION OF:

RESULTS
RESOURCES

INTERPRETATION OF A PRODUCTIVITY RATIO OF THIS TYPE REQUIRES:
AN UNDERSTANDING OF:

- 1) RESULTS,
- 2) THE DESIRED MIX OF RESULTS,
- 3) THE RESOURCES AND RESOURCE MIX, AND
- 4) THE RELATIONSHIP OF RESOURCES TO RESULTS

X-BOOTSTRAP CAN HELP AN ORGANIZATION DEVELOP MEANINGFUL
PRODUCTIVITY RATIOS FOR PLANNING AND CONTROL PURPOSES.

COMPENSATION IS A FUNCTION OF:"

EXPERIENCE
COMPANY
OTHER COMPANY

KNOW-HOW
MANAGERIAL
TECHNICAL
PEOPLE

PROBLEM SOLVING
THINKING CHALLENGE
THINKING ENVIRONMENT

ACCOUNTABILITY
FREEDOM TO ACT
DOLLAR IMPACT OF JOB
DEGREE OF RESPONSIBILITY

WORKING CONDITIONS
ENVIRONMENT
PHYSICAL EFFORT

PERSONNEL EFFECTIVENESS IS A FUNCTION OF:

- JOB REQUIREMENTS
- RECRUITING
- SELECTION
- TRAINING
- PERFORMANCE APPRAISAL
- COMPENSATION
- LABOR RELATIONS
- CAREER DEVELOPMENT

JOB PERFORMANCE IS A FUNCTION OF:

QUANTITY OF WORK

- OUTPUT 1
- OUTPUT 2
- OUTPUT 3

QUALITY OF WORK

- OUTPUT 1
- OUTPUT 2
- OUTPUT 3

KNOWLEDGE OF JOB

- SUBSYSTEM 1
- SUBSYSTEM 2
- SUBSYSTEM 3

PERSONAL QUALITIES

- PERSONALITY
- APPEARANCE
- SOCIABILITY
- LEADERSHIP
- INTEGRITY

COOPERATION

- SUPERVISORS
- ASSOCIATES
- SUBORDINATES

DEPENDABILITY

- TIME SCHEDULES
- ATTENDANCE

INITIATIVE

- SEEKING RESPONSIBILITY
- SELF-STARTING

APPENDIX H

AN ALTERNATE ANALYSIS OF SURVEY DATA

There are many ways to manipulate the data in Tables 7.2 to 7.7 for further analysis. One of these ways is presented below.

In Tables 7.2 to 7.7 there appears to be significant differences in the importance of the subdimensions across each element and within each grade level. Yet, these differences can be greatly modified by converting to relative weights (versus normalized weights) across each subdimension.

In the data sets of relative weights below, the values were computed by multiplying the normalized "major" dimension weight times the normalized "subdimension" weight. For example, with respect to the GND COL data, the normalized weight of the major dimension "personnel", was multiplied times the subdimension "percent manning level", to obtain the relative weight. Like computations were conducted for each subdimension factor, i.e.:

$$\text{Overall Personnel } (.45) \times \% \text{ Manning Level } (.46) = .21$$

These relative weights may be useful in identifying the relative importance of subdimensions across elements and

grade levels, thus reducing any aggregation issues that may arise in interpretation of the results in subject tables.

Personnel Model Values:

<u>Ground:</u>	COL	FG	CG
% ML	.21	.10	.05
SEXP	.12	.04	.04
CMOS	.07	.04	.03
> E5	.05	.04	.04

Air:

% ML	.14	.07	.07
SEXP	.03	.05	.05
CMOS	.07	.03	.06
> E5	.05	.06	.03

CSS:

% ML	.11	.11	.13
SEXP	.05	.04	.04
CMOS	.20	.07	.07
> E5	.07	.04	.07

Equipment and Supplies Model Values:

<u>Ground:</u>	COL	FG	CG
% Equip	.11	.10	.08
% Supplies	.08	.06	.07

Air:

% Equip	.08	.08	.09
% Supplies	.08	.04	.07

CSS:

% Equip	.13	.11	.13
% Supplies	.06	.06	.08

Equipment Condition Model Values:

<u>Ground:</u>	COL	FG	CG
% Equip	.08	.09	.08
% EI	.04	.06	.05
Mod	.01	.01	.03

Air:

% Equip	.09	.07	.08
% EI	.06	.05	.08
Mod	.01	.02	.03

CSS:

% Equip	.10	.10	.10
% EI	.02	.07	.07
Mod	-.01	.02	.02

Training Model Values:

<u>Ground:</u>	COL	FG	CG
Indiv	.04	.10	.13
Unit	.04	.07	.08

Joint Navy	.01	.01	.04
Joint MAGTF	.01	.02	.05

Air:

Indiv	.06	.11	.13
Unit	.05	.08	.12
Joint Navy	.02	.02	.04
Joint MAGTF	.03	.05	.04

CSS:

Indiv	.05	.08	.09
Unit	.03	.07	.05
Joint Navy	-.01	.02	.02
Joint MAGTF	-.02	.03	.02

C4 Model Values:

<u>Ground:</u>	COL	FG	CG
Morale	.05	.06	.05
C3	.03	.04	.03
COs J	.02	.09	.06
Ldrshp	.02	.05	.07
Intel	.02	.03	.01

Air:

Morale	.04	.06	.03
C3	.09	.02	.02
COs J	.05	.08	.02

Ldrshp	.06	.04	.02
Intel	.02	.03	.03
<u>CSS:</u>			
Morale	.04	.05	.02
C3	.03	.04	.02
COs J	.03	.07	.03
Ldrshp	.02	.04	.04
Intel	.02	.01	.02

By using a Lotus 1,2,3 type of spreadsheet package, a myriad of graphs (pie, bar, line, etc.) could be developed to present the above results. Yet, without the ability to print them in color much of the graphics effect is lost. Accordingly, no graphics were prepared for this study.

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